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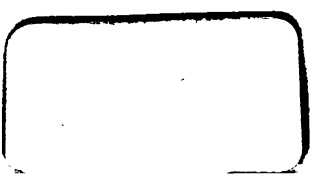

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CHRIST AND SCIENCE

The Cole Lectures for 1906
delivered before Vanderbilt University

Christ and Science

Jesus Christ Regarded as the Centre of Science

By
FRANCIS HENRY SMITH
Professor in the University of Virginia

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THE COLE LECTURES

THE late Colonel E. W. Cole of Nashville, Tennessee, donated to Vanderbilt University the sum of five thousand dollars, afterwards increased by his widow to ten thousand; the design and conditions of which gift are stated as follows:

"The object of this fund is to establish a foundation for a perpetual Lectureship in connection with the Biblical Department of the University, to be restricted in its scope to a defense and advocacy of the Christian religion. The lectures shall be delivered at such intervals, from time to time, as shall be deemed best by the Board of Trust; and the particular theme and lecturer shall be determined by nomination of the Theological Faculty and confirmation of the College of Bishops of the Methodist Episcopal Church, South. Said lecture shall always be reduced to writing in full, and the manuscript of the same shall be the property of the University, to be published or disposed of by the Board of Trust at its discretion, the net proceeds arising therefrom to be added to the foundation fund, or otherwise used for the benefit of the Biblical Department."

BV 4-47-6 C

Ἐξ αὐτοῦ καὶ δι' αὐτοῦ καὶ εἰς αὐτὸν τὰ πάντα. αὐτῷ ἡ δόξα εἰς τοὺς αἰῶνας. ἀμήν.

ROM. xi. 36.

Hae tibi Sacrosanctæ mentis illius vivam referunt imaginem, ipsumque Christum loquentem, sanantem, resurgentem, denique totum ita presentem reddunt, ut minus visurus sis si coram oculis conspicias.

ERASMUS.

Contents

THE OLD TESTAMENT IN ITS RELATION TO PHYSICAL SCIENCE . 11

THE NEW TESTAMENT IN ITS RELATION TO PHYSICAL SCIENCE . 55

SCIENTIFIC HINTS IN BOTH TESTAMENTS 111

CHRIST'S LOVE OF NATURE . . 147

CHRIST THE MODEL FOR THE TEACHER OF SCIENCE . . 179

THE GREAT TEACHER HIMSELF . . 211

LECTURE I

THE OLD TESTAMENT IN ITS RELATION TO PHYSICAL SCIENCE

LECTURE I

THE OLD TESTAMENT IN ITS RELATION TO PHYSICAL SCIENCE

TO a great multitude of men, called Christians, the greatest fact in the world to-day, is the existence of the Christian Church. To them the greatest fact in the Christian Church is the presence of Christ, not merely by His precepts and example, but His real, personal, though not bodily presence. Brahmah, Buddha, Confucius are dead. Christ, as His followers believe, lives and is here. In our solemn assemblies He is addressed as though He were not far away. In the Christian's daily walk, the whispered or perhaps unuttered prayer indicates his belief that his Master is very near to him. Nay so close may be this union, that in a high sense, but a very real and unmystical sense, Christ may be said to live in him.

This unique relation of our Lord to His people becomes transcendently significant when it is remembered that they believe Him to be, what He distinctly claimed to be, the greatest personage in this and all worlds. Human language seems inadequate to express even the partial conception of Him which alone we can form. He is said to be the Word of God. This title appears to include every possible way in which God may be manifested to men. "No one knoweth the Father but the Son and he to whom the Son will reveal Him." Christ, as His followers believe, is the author of every revelation of the Almighty whether in the physical or spiritual world or in the written word. In every such disclosure we may discover the handiwork and trace the lineaments of Him who is "the brightness of the Father's glory and the express image of His person." They are all epiphanies. If the Holy Spirit is the Divine breath, Christ is that breath articulated and made intelligible. When God speaks we hear Christ, and there is no

other way to God, either for our thought or our faith except through Him.

For this primacy of our Lord, let us listen to the Sacred Oracles.

"By the word of the Lord were the heavens made and all the host of them by the breath of His mouth."

"For by Him were all things created that are in heaven and that are in earth, visible and invisible . . . all things were created by Him and for Him" (Col. 1 : 16).

"By whom also God made the worlds" (Heb. 1 : 2).

"But unto the Son He saith . . . Thou Lord in the beginning hast laid the foundation of the earth and the heavens are the work of Thine hands" (Heb. 1 : 10).

"Thou art worthy, O Lord, to receive glory and honour and power, for Thou hast created all things and for Thy pleasure they are and were created" (Rev. 4 : 11).

"All things were made by Him and without Him was not anything made that was made" (John 1 : 3).

These and other passages declare that Christ is the maker of all worlds material and spiritual, visible and invisible. "*All things*" comprehends universal creation.

If our Lord be the maker of all worlds they must bear signs of Him. Not more surely will the student find Michael Angelo in his Moses, or Raphael in his Transfiguration, Milton in Comus or Shakespeare in Hamlet, than the Christian may expect to find Christ in nature. The sciences of mind and matter should to *him* bear marks of the same author and that author his Lord. If Christ's claim be true, the universe seen and unseen is a unit—and its unity is only intelligible when arranged about Him as a centre. To the Christian all science is Christo-centric. To refer it to any other centre or to no centre is to introduce confusion.

There are obviously two ways of studying the connection between the Creator and His works.

One way, the time honoured way, practiced from the beginning is to start from the works, and by patient study of them, pass upward

to him. To prove the being and attributes of the Almighty by the works of Nature has been the delightful task of many of the greatest minds of the Christian era.

This appears to be the natural and appropriate way; to ascend from the creation to the creator: to climb the ladder, for we are at the bottom, and beginning there seems to be not only the humble method but the reasonable method.

In my boyhood, no books were oftener quoted than the Bridgewater Treatises. There were eight of them, written to win prizes offered by the Earl of Bridgewater for the best essays proving the being and perfections of God by the works of Nature. A great contemporary philosopher, Dr. Babbage, was dissatisfied with them, and without seeking a prize, published a ninth Bridgewater Treatise to remedy the supposed defects. His dissatisfaction seemed to be a prelude to a widening sense of inadequacy in the argument, and the Bridgewater Treatises are rarely heard of now. This has somehow been the fate of numerous other

similar essays. Indeed the reason is not far to seek. Nature is not only a very vast and difficult field, only in very small part known, but it is a rapidly widening field. Much of the knowledge of one age is merely a stepping stone to be used in the next age for climbing higher and then to be abandoned. A few great leading principles are permanent, but the details and the filling in are constantly modified and improved. Thus it comes about that an interpretation of one age becomes valueless in a subsequent one, because the thing interpreted is found to be no fact. So it has happened that some serious thinkers, by no means sceptical or agnostic, have questioned the possibility of proving the existence of Deity from the phenomena of the material world, and a few free thinkers have stoutly denied it. One of the ablest of these, however, Mr. George J. Romanes, near the close of his life recalled his scepticism on this point. Leaving out of account all lesser considerations, a large view of the universe disclosed to him such undeniable, irresistible evidences of plan and design,

that his truth-loving soul bowed reverently before the Almighty, though seen only through this one rift in the clouds. From an honest doubter he became an honest believer. The great Apostle Paul believed in a Natural Theology. He held the wicked Romans to be without excuse, because those invisible things, the eternal power and Godhead of the Almighty—were clearly seen by the things that are made. To the men of Lystra he had before declared that the goodness of God, as seen in Nature, bears witness of Him. "For He did good and gave us rain from heaven and fruitful seasons."

We all remember too how the great English prelate, Butler, used the Constitution and Course of Nature as a powerful defense against the foes of religion both natural and revealed. Yet after all, to find the Creator from His works, is like trying to find the centre of a circle from its circumference: nay, considering the smallness of our knowledge of those works, from a very brief part of the circumference. As a practical matter the chances are all against our striking the

centre by any straight line drawn from the circumference. The process, exact only in theory, becomes merely approximate in practice.

We propose a new way. Let us begin at the centre and go to the circumference. We cannot miss it, if we go straight. Let us start from Christ, who claims to be and whom Christians believe to be the centre of the created universe. I shall consider only the material world, leaving to abler hands the corresponding inquiry as to the spiritual world. If Christ be the maker of the visible universe, what kind of a universe have we a right to expect it to be? Judging by His character and His declarations, what sort of a world has He made? Is it the world we have? If so far as our limited faculties and our admittedly partial knowledge enable us to see, the world around us is in great essential facts about which we are certain, the same world we looked for if Christ be its author and centre, the correspondence cannot fail to give satisfaction to the Christian, and to the honest sceptic perhaps help towards rest.

In trying to follow out this argument, let us not forget that humility becomes the inquirer, for while we know some things certainly about our Lord and His universe there remain to us possibly infinite treasures of knowledge of each, to be slowly gained as the years move on. This fact should not prevent our making use of the truth so far as we have it, being confident that growing light will only help us to see better the things we already see well.

Beginning now at the centre, we recognize that our external knowledge of Christ is derived, not from tradition nor from secular writings, but from the Bible. It is one of the strangest facts in human history that a personage so exalted and unique, dropping words such as the world might well stop its busy life to hear, should have attracted no attention from contemporary secular historians or philosophers. Tacitus had time to enlarge upon the acts of an obscure tribe of barbarians, or the doings of an infamous court favourite, but no eye or ear for acts and words which have altered the map of the world and

changed the course of history. The Bible and the Bible alone is our biography of Christ. The Old Testament is a light shining forward: the New Testament a light shining backward —both concentrated upon and revealing the same person; and neither is complete without the other. The Lord Himself said: "Search the Scriptures (that is the Old Testament) for they are they which testify of Me." The testimony of the two Testaments as to our Saviour is so full that we need no help from tradition or secular sources. In a remarkable passage the great Erasmus declares that "these Scriptures give us a living image of that Divine being and reveal Christ Himself speaking, healing, dying and rising again: indeed they make Him in His entire being so vividly present to us that we see Him better than if He stood before us bodily." In a glow of emotion this great scholar exclaims, "Let us thirst for these sacred writings with all our soul, let us embrace them, die in them at last and be changed into them, for what we study that we are."

To ask therefore what is the relation of

Christ to Science is to ask what is the relation of the Bible to Science. Its declarations are His declarations. Its attitude on any question is His attitude. What then does the Bible teach us as to the external world? The various books of the sacred Scriptures are very different in the number of their references to that world. Some of these books, like Job, Ecclesiastes, the Psalms and the discourses of our Lord are rich in them. Others like the historical books, many of the prophecies and the Epistles, have very few.

These references to external nature are partly illustrative and rhetorical, for the Bible is not a text-book of science, and such allusions are only auxiliary to its high purpose. Being illustrative in large part, to be intelligible, they must conform to the views however unscientific, which prevailed among the people addressed. Else instead of bringing light to the subject, they would have brought darkness—and would have been adumbrations and not illustrations. With these rhetorical uses of Nature, our argument has nothing to do.

There remain two other classes of statements with regard to the physical universe. The first of these are the so-called miraculous events—events which are "little wonders" because they involve effects unexpected and apparently without a physical cause. A proper study of them requires a contemplation of both worlds, material and spiritual, and a discussion of the possibility of the transit of energy from one to the other. This would take us far beyond the humble task we have proposed to ourselves at this time. Before passing from it, may we not be pardoned for saying, that a miracle is not a violation of the order of Nature? What is the order of Nature? Is it a fixed succession of events? So it seems perhaps to the young astronomer.

In those vast abysses of space, where giant suns and clusters and nebulous clouds pursue their solitary majestic courses, at such huge intervals as to make collisions all but impossible, we have a spectacle nearest to a permanent picture, of anything known to us. Fixed stars, we call them. For ages they present to the observer the same patterns and fig-

ures. The shepherd boy, David, would know our Orion and Arcturus were he here to gaze upon them. Now and then, however, to the minute scrutiny of the modern telescope, a sudden interruption of this stability occurs. A new star blazes forth or one long known vanishes. A mighty collision has occurred. The fixed succession has been violated, but the order of Nature remains undisturbed, for the same laws of motion which are revealed in the uninterrupted march of some, required the collision of others, and, by competent intelligence, might have been foreseen for ages. Such catastrophes belong to the order of nature. When we descend to the earth this order becomes complicated.

There are great successions of phenomena, like the seasons, the ocean currents, the trade winds, which remain the same, and may be foreseen; along with them, however, are hundreds of events less amenable to prediction. Especially is the variation from a fixed order manifested where man's interference is possible. Rivers are moved from old channels; Niagaras are taken from spectacular leaping

and harnessed to humdrum work; seasons are modified by destruction of forests; seas are united by great canals; and many things made to happen which never happened before.

In all these the fixed succession of events is constantly abrogated. Is the order of Nature violated by such interruption? On the contrary, would not that order be violated if such interruption did not occur, when the conditions have been changed? The introduction of volition (touching the triggers of unused stores of potential energy), must bring new things to pass, and the order of the world would be destroyed if the old things kept on. The true order of Nature is, that every effect must have a cause, and every cause must have its effect. Hence if a new cause be introduced, a new effect must arise, if the order of Nature is preserved. A *miraculous event* is then a violation of natural order only if it can be proved to be causeless. The order of Nature is synonymous with an unchanged succession of events, only so long as no new cause is introduced. If God intervenes, a miracle belongs to that order.

There remains to us in the Bible a third class of statements as to the material world comparatively few in number, which are not illustrations but revelations. They are positive declarations which reach to the reality of the things we see, and which, being in the Bible, must be true of any universe which Christ has made. They may not be conformable to the science of the times in which they were written, nor to that of many ages afterwards. The boldness of these declarations is such that if they were made in a mere human uninspired document, it would argue a reckless folly on the part of the writer, inconceivable in a person of ordinary judgment. No human being would venture on positive statements of novel character which he need not make, and which, once made, might imperil the credibility of his entire treatise. But if a Divine being speaks there is no room for caution or timidity. The boldness which would be weak in a man, is the proper tone and sign of a God.

We ask your attention to some passages of this kind in the Old Testament. That

Testament opens grandly with a tremendous statement as to the material world. Even in our English version the words roll out with indescribable majesty: "In the beginning, God created the Heaven and the Earth." The material universe is declared by the Bible not to be eternal. It began in time, and it owed its origin not to physical causes. This origin is asserted to be superphysical. The Bible declares that the chain of physical causation reaching backwards farther and farther, is not endless. It stops at a definite moment in the past and at that end is an act of God.

What a contrast is seen between these clear simple words of the Bible, and the obscure, non-committal and sparing references reported to us by students of the sacred books of India, as given in those venerable documents with regard to the primordial universe! They seem to assume that the ultimate matter, the Urstoff or Protyle of the philosophers is eternal, and that the beginning of the world was merely the formation of stars and worlds, out of this everlasting material. In contrast

with these vague and dreamy views, our Holy Book speaks with a simplicity and authority befitting Divinity.

But the Bible goes farther. It recognizes that matter is not the only constituent of the universe. To make a world, the matter must be endowed with power. Matter alone would give a world motionless and dark and silent. Matter with energy gives a world of movement, shining and singing. Having just declared the origin of matter to be superphysical, the Holy Scripture now proceeds to declare the origin of energy to be *superphysical.* Of all the forms of energy, light is the most universal and most typical. It is therefore selected by the Old Testament writer as the symbol of all energy. The created world of matter lay without form and void, and darkness covered the deep. "And God said Let there be light, and there was light." Energy is therefore declared by the Bible not to be eternal. It too, came into the world at a definite time, and its beginning was not physical but superphysical.

But matter and energy will not make a

complete world. They will make solar systems, with all their shining members in harmonious circulation. It will be like a house with all its furniture, but no inhabitant. The Bible completes its universe by adding life to matter and energy. Life too had a beginning and that beginning was superphysical. "And God said, Let the Earth bring forth grass: Let the waters bring forth abundantly the moving creature that hath life: Let the Earth bring forth the living creature after his kind." Finally the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life. Life, therefore, was no product of matter and energy, but owed its origin to the superphysical act of God.

Christ's universe, therefore, is composed of matter, energy and life. No one of them is eternal. They all originated in time, and their origin is alike "supernatural." The "natural" forces in Christ's universe cannot create or annihilate energy, and therefore cannot add to or subtract from the matter, the energy, or the life that are put into it.

The challenge is made. The gauntlet is cast. The voice of Christ is clear. It was uttered before science had an existence. Matter, Energy and Life are superphysical in their origin, said the Bible three thousand years ago. This is a fundamental truth in the world which Christ made.

Is this the universe we have? Do matter, energy and life make it up, and are the forces of nature as we have them, incompetent to produce either matter or energy or life? For two thousand years after Genesis was probably written the answer would have been No. The nineteenth century has reversed this answer, and we now say Yes.

The physical universe, speaking only of that portion, possibly only a small part of it, which is known to us, is a scene of amazing variety and magnificence. Man stands between two infinities, one stretching out above him into worlds on worlds immeasurably numerous, grand and distant: the other descending beneath him into smaller and smaller groups and constituents: a universe of atoms as innumerable and complex and orderly as the

great orbs above us, but unlike them invisible. These infinities great and small can only be studied by classification. Not individuals, but species, genera, orders, classes, —are all we can at large describe or learn. The material world is a wonderful picture. The photographs of the starry heavens each giving a small portion of the great celestial vault, disclose a richness surpassing the splendid profusion which even the telescope helps the eye to detect in the same field, for photography is keener than vision.

No microscope or camera can seize the other universe. The atom and molecule, that we know better than the distant stellar units, are seen and doubtless will ever be seen only by the eye of faith. In this vast expanse, events are taking place which strongly suggested to the early enquirers the fluctuating character of the materials of the world.

The disappearance of heavenly bodies, or their appearance where they were not before; the vanishing and reappearance of clouds, the disappearance of fuel in burning, and of water from a shallow pool,—were believed by

many of the ancients to indicate destruction and reproduction of matter. To them the thought that a bit of matter could perish or be reproduced was not only not untrue, but was apparently the verdict of common sense and ordinary observation. The opposite opinion grew slowly into scientific consciousness.

The close of the eighteenth and the opening of the nineteenth century may be regarded as the era of the rise of modern chemistry. Dalton and Lavoisier, with the brilliant associates of the latter who helped to make the Napoleonic times so remarkable, led in a critical study of the disappearances and appearances of matter in chemical acts of decomposition and recombination. Bringing the question involved to the test of highly improved balances, chemists were able to show that in all the operations they studied, there was no variation which their balances could detect in the sum total of the matter employed. Such analyses are the common work of every laboratory in the world, and in the century since Lavoisier died, millions

of these scrutinies have occurred, with not the slightest evidence that a single atom has ever been added to or taken from the aggregate in the world by natural agencies.

What a few minds in the former ages suspected to be true, is now accepted as established truth. Chemistry has given us the great doctrine called the *Conservation of Matter*, namely, that the forces of nature studied by scientists, can neither create nor destroy matter. In all its multiplied changes the alteration is only of form and place, and not of total quantity.

An objector may here interpose and say "Your statement is based on the operation of weighing. Is your balance perfect? Can you weigh an atom? If one were added to or subtracted from the load, is there a balance on earth that could detect the fact?" In reply we must admit, that our balances are imperfect and that there are masses so small that the best balance is insensible to their weight. But we can with the balance weigh a mass too small to cause it to turn. The balance is the most exact weighing instrument

we have, and while we have instruments more sensitive, we have none so steady and consistent as it. The balance stands in those respects at the very head of all our measuring apparatus. So sensitive may it be, that it is reported by a former head of the Coast Survey that a balance in possession of that office will indicate a difference in the weight of two small cubes according as they are placed in the pan side by side or one upon top of the other.

Repeated careful weighings of the same object with a fine balance do not exactly agree, but the variation is extremely small. The whole number of results is found to cluster closely about a mean value which is far less fluctuating in a number of trials than any individual weighing. The departures of the separate weighings from this mean are on both sides of it, and there are many more minute variations than large ones. This mean result is accepted as the best value of the weight which the whole series of trials gives. Using the balance thus, chemists declare that they can find no evidence that

the mass of a compound is different from the sum of the masses of its constituents. Now, the balance has slowly become more perfect since Lavoisier's time, but its increased accuracy has not served to detect any fault in the law of conservation of matter. Of course it is always possible, without a perfect instrument used by a perfect being, to locate an objection by naming a mass too small to be detected: but it will strike the honest thinker that a quantity less than any measurable quantity, and dwindling as the instrument is improved, would be zero with a perfect instrument and has no existence.

The great doctrine of the Conservation of Matter is too often identified with the assumed fixity and permanence of the so-called elementary bodies. Attempts to transmute the metals, or decompose into simpler bodies any of the received elements had always failed. Clerk-Maxwell in a celebrated essay uses these elements as natural finalities, and as being outside of any possible evolution. They do not seem to have grown to be what they are. Yet other great philosophers were

not of that opinion, for Faraday confessed he had worked at transmutation, and Dumas in similar efforts reached some results that were at least suggestive. Indeed it has constantly been declared by chemists that by elements they do not mean bodies absolutely irreducible, but only irreducible under existing conditions and by existing means. At a previous period of the earth, and even now in our Sun or other stellar systems, some of these bodies may be replaced by simpler constituents. The world was therefore not unprepared for the remarkable discovery of the past decade that certain new bodies, called at first elements, were in a state of active molecular change; in all probability, spontaneously passing to simpler bodies, and evolving surprising amounts of energy of radiation in the process.

We have been led to suspect by the facts of radio-activity, that a few of our metallic elements are not permanent, but are passing with a slowness that may require ages for the completion of their history into lower, simpler and more stable forms. Enthusiastic theor-

ists snatching these fragments of truth are, after their usual practice, already running to the wildest conjectures as to the history of our elementary bodies, and see clearly that our silver becomes lead and our gold changes to copper.

There is nothing very new or impossible in the most extravagant of these dreams. Chemists have for long years made us familiar with multitudes of bodies whose molecules are easily resolved in the laboratory, and spontaneously so in nature around us, into simpler ones. They give us also the contrary phenomenon of constructing from simple unpromising materials, most complex new bodies of the strangest and most interesting properties. The gorgeous colours of the aniline series are developed from coal: and the tremendous power of nitroglycerine from harmless beginnings. How easy, then, is it for us to admit that uranium may degenerate into radium and radium into helium, and that possibly in some distant star recently, or in some distant epoch of our sun's history, helium may have been raised to

radium and radium to uranium. Has all this anything really to do with the conservation of matter? Does any one dream of making radium out of nothing? The conservation of matter does not mean the permanence of any form of it or any state of aggregation, but the preservation of its total amount. The great law of the conservation of matter is no more attacked by the decay of uranium than by the decay of a leaf. The passage of matter from more intricate to more elementary forms has been universally recognized. Such processes are only now extended possibly to forms heretofore believed to be invariable.

Should all the chemical elements be finally proved to have come originally from simpler forms and to be only the more stable and yet possibly not final forms of degradation, it would, I believe, be no shock to our leading chemists, who taught us years ago that the "element" was only conditionally permanent. None of these transformations, actual or possible, historical or prophetic, involve the creation or annihilation of a single atom.

A more serious attack on the doctrine of

the conservation of matter appears in the recent speculations of certain living scientists of great repute. The times we live in are remarkable for the number and eagerness of scientific enquirers. Their emulation and restless activity put a premium on hypothesis. Scientific restraint and patience are gone. Our fathers, like Kepler, could wait a century for an interpreter: but with us the slightest new fact starts a world of speculation, and book and magazine and lecture platform resound with philosophic clamour till the next discovery directs attention another way.

A recent observation of a very able man has led him to push molecular theory far beyond the point at which we just now left it. He suggests the possibility of the analysis of the elements reaching such a stage of simplification that there would be but one final substance, and that would not be what we know as matter in the form of the "elements." So far it is an old story. The idea of a single ultimate material out of which all things are made was not unfamiliar to the ancients. In more recent times the

Jesuit father, Boscovich, used it in a beautiful atomic theory, which as a static theory has never been approached for clearness and fertility. As the same material carbon gives us the soft black coal, the hard crystalline graphite and the yet harder and flashing diamond, the contrasted properties of which must be explained by collocation: just as the humble cottage and the stately cathedral in a city may be made of the same kind of bricks, so it is a captivating hypothesis that the endless variety in nature may arise from the different ways in which the same constructive material is used.

But the brilliant professor goes much farther. This ultimate material may not be ordinary matter at all, but only electricity. The electric atoms, or electrons are what we know as negative electricity, the *positive* being merely a deficiency of negative. The professor has most ingeniously imagined a kinetic atomic theory in which different numbers and arrangements of these electrons would constitute molecules of matter with many of the qualities, which are associated

with ordinary matter, such as radio-activity, valency and periodic properties.

To some it appears that so far from matter being preserved, this speculation makes it altogether vanish. It does, if you identify matter with the chemical elements. But the electrons have mass and their combinations do not create any new mass. The molecule they build up has a mass equal to the sum of its electrons. No one would more quickly assert that the conservation of matter is as true of the electron world, as it is of the derived world, than the eminent author of this new proposition. It is true that there is one sign of mass, its inertia, which we have been used to regard as invariable as the mass itself, but which in the new theory must be modified. The apparent inertia of an electron, or ultimate electric atom, and therefore its apparent mass, depends on its speed.

With a speed approaching that of light, it appears much heavier than it is. But when we look closer, this is accounted for by the fact that at their highest speeds the ether is sensibly disturbed and its inertia is added to

that of the electron. When an Atlantic liner is at its greatest speed, no small weight of salt water is dragged with it and increases its inertia. Yet the ship itself is no heavier. Obviously this peculiar feature of the electron theory is no real denial of the proposition that the sum total of matter in the world is not altered by the natural processes taking place there. Looking ahead, it is not difficult to see that the next step in the analysis will be to make the electron out of the ether in which it moves, and which supports its activities, and at last we shall have but one thing in the universe. But this would again not attack the conservation of matter, for the ether is matter, and was always included in the law. We have simply pressed the decomposition to its last stage, but the tumbling down of a house does not alter the weight of its materials.

Our conclusion, therefore, is that the century since Lavoisier died, has not contradicted but has supported the great truth for which he was sponsor. The scientific world to-day puts the doctrine as one of the corner stones

of our physical science. The world we live in is characterized by this feature, that the material of which it is made is not changed in amount by the forces operating in it. So far as they are concerned the aggregate amount of matter is the same, yesterday, to-day and through all time.

But the world is more than the objects in it. When we have counted the stars and exhausted the catalogue of terrestrial objects, we have only noted a part and that the least part of the universe. No photograph, however minute and faithful can represent the world except at one moment. It is not a picture or panorama, but a theatre. Its constituent bodies are not self-defined and independent. They are perpetually changing and their changes are due to and determined by their neighbours. What a body is, makes a most interesting study. What it can do, is a far nobler and higher study. The rank of a member of the material world, whether sun or planet, tree or rock, is fixed by the amount of power it has to influence other bodies. This power—energy, it was called by St. Paul

nearly two thousand years ago—is, though invisible, the most precious thing in the world. Like all high things it is inexpressibly delicate and fugitive. Philosophers tell us that it is incessantly passing from body to body, often with the speed of light, and that these transfers constitute really the events of the visible world.

The quantity of energy possessed by any one body is, therefore, in a state of incessant change. That the sum total of a thing so fluctuating and variable in individuals, should in the aggregate be unchangeable, would have appeared, a century ago, a most questionable proposition, if not highly improbable. But before the guillotine had slain Lavoisier, a few great scientists in France, England and Germany were laying the foundation for a declaration on this point that would vivify every department of science. Newton indeed had virtually uttered it more than a century before, but the statement was unintelligible to his readers. It was left for the nineteenth century in its first half to bring to light the grand doctrine of the conservation of energy,

namely, that in the countless operations of Nature, and in all the transfers and transformations undergone by the noble fugitive they called energy, there is no alteration of its amount. Natural forces neither create nor annihilate energy. They only pass it to and fro. So far as they are concerned, its total quantity in the world is invariable. We can follow its changes in the simpler phenomena of visible motions studied in physics, and in the more hidden processes of heat and electricity. Here we can measure the energy passing. In the more intricate facts of chemistry, and finally in the higher and yet more complex field of biology, the law of Conservation of Energy has been of incalculable value in directing lines of research and it has never led to error. It is universally accepted as one of the foundation stones of physical science. Only a true principle will always lead us right.

The manifestations of energy in the universe furnish a basis of classification of its innumerable constituents of the most fundamental character. The greatest inequalities

prevail. Some bodies are so rich in this splendid endowment that they are raised to a lofty height in creation. For ages they pour forth this treasure in lavish abundance, and these constitute a kingly class. Such marvellous centres of radiation are the countless suns in celestial space. They are numbered by at least a hundred million, while the dark bodies, poor in energy, which receive supplies from them, are many times more numerous. Up to a very recent time the astronomer alone could present to us these tremendous localizations of energy—the foci whence light and heat pass incessantly to less favoured bodies to be transformed there into the manifold varieties of energy, making up a complete planet.

Thus we have been told from our childhood that the multiplied activities of our own earth, in sky and sea and land, are only changes rung upon the energy unceasingly poured upon us from the sun, whose children all our forms of life and motion are. It is a beautiful truth, worthy of all the elaboration it has received from scientists and poets. But

recent discoveries have revealed to us depositories of energy of such transcendent magnitude, all around us and in us, that we no longer need to ascend into heaven or take the wings of the morning to find them. The study of radium and its associates in activity reveals to us an amount of energy bound up in the molecules of matter all about us that makes the radiant wealth of a star seem an ordinary thing. It has been computed by Professor J. J. Thomson in his Yale lectures that a gramme of radium which emits per hour enough heat to raise one hundred grammes of water one degree, would take fifty thousand years to exhaust its energy. This means energy enough to raise a battleship of eighteen thousand tons more than three-fourths of a mile. If such be the amount of energy in a minute amount of this metal it is oppressive to our imagination to consider what tremendous stores of it are locked up in the invisible atoms which make up the world in which we live. In all these molecular accumulations, no fact has yet appeared to indicate that radio-activity is more

than transfer and transformation of energy, without at all affecting its total amount.

But the nineteenth century had yet another great contribution to make to human knowledge. Matter and motion do not make up the whole of the world we know. Our earth at least is enriched with the presence of life. We can no more define life than we can define matter, or motion, or time, or space. Yet we know them well enough never to confound them or take one for another. The attempted definitions of life are curious mental exercises, making obscure what at least we felt was clear enough before. The beginning of life in the world is a problem which to mere naturalists is invested with unspeakable difficulty. To attribute it to germ-laden meteors from a distant sphere would sound more like a jest than a sober hypothesis, if we could forget that a Scotchman proposed it.

The notion that in some way unliving matter may rise to organized living forms is as old as history. Students recall with merriment Virgil's method in the Georgics

of producing a swarm of bees. The search for the origin of life, as a mere scientific exercise, is a fascinating one. Professor Bastian fifty years ago believed that he had seen life appear where there had been none. It is a noteworthy fact that the men who subjected his experiment to a merciless criticism and demonstrated his mistake, were two leaders, known as sceptics, who might have been expected to welcome the asserted fact, but whose love of truth rejected a claim in which their scientific skill detected and exposed a fallacy. The chase of the *ignis fatuus* still goes on. We hear of attempts at home and abroad. Without specifying them here, the sober judgment of those best able to estimate these interesting trials, is at most the Scotch verdict "not proven." The unanimous opinion of biologists to-day appears to be that which was enunciated by the great masters of the nineteenth century from Linnæus on to Darwin, Huxley and Gray, that life is not produced from unliving matter. The great doctrine of the Continuity of Life takes its place by the side of those

other fundamental truths—the Conservation of Matter and the Conservation of Energy.

If one is asked, "What are the great scientific triumphs of the nineteenth century," he would be apt to mention the steamboat and locomotive, the common telegraph, telephone and wireless telegraph, the high-power rifled cannon and the ironclad, the sewing machine and typewriter, the dynamo and electric light. These are great things and make that century a marked one. But greater than all these inventions, and lying in a higher plane are the three great scientific generalizations—the Conservation of Matter, the Conservation of Energy and the Continuity of Life. These lift that century to primacy over all its predecessors. That century was the first that enabled us to answer the inquiry with which we set out.

In view of what has been said, the idea entertained by some, that the honest study of Nature leads away from a Creator, would seem to be unfounded. If an honest scientist were asked to account for the beginning of matter or energy or life, he would have to

admit that science can give no account of it. The forces she studies—the only ones he finds in the operations of the world—have no power to create an atom or a monad. Hence to ask science to tell how they came into being, is like asking a blind man about light, or a deaf man about music. For the scientist to say that because science tells nothing about absolute beginnings or endings, there are none such, is as if the man without eyesight should declare there is no light. Sound science does not affirm the *eternity* of matter, energy or life; she merely says when asked about the origin of either, that she does not know, that she has no means of telling it: that the inquirer must resort to some other source of knowledge than science for an answer to his question. I step into a lecture room and see on the blackboard a circle. It has no sign of a beginning or end. If I am asked to find its origin, geometry cannot help me to an answer. Must I say that it is eternal? Not so, for a bystander of established character, tells me that he was present when it was

drawn and can designate the point from which it started. So when science cannot tell us the origin of the world the testimony of one who was at its beginning may satisfy our questioning.

Is the world as we know it the world which the Bible declares that Christ made? The world of the Bible was declared to be one whose matter, energy and life were all of supernatural origin, and therefore one in which mere natural forces could work no new addition to either. After thousands of years of slow patient inquiry, modern science declares that the actual world is one characterized by these very features; that the forces at play in it can make no atom, can create no energy, can start no life. In the most fundamental and universal of all principles, Christ's world and this world are thus identified.

The irresistible inference is that the Bible is right: Christ did made the universe. He is here, not by courtesy, nor in a foreign or hostile field, but in His own house. This splendid array which comes from His hand cannot be unfriendly to His highest work.

All things were made by Him. They were also made for Him. The Christian may walk in every direction through this wonderful creation and humbly feel that he has a right to be here. He is at home, in his father's house. Its light and beauty are for him. They were made by his Lord, whom he may see in every flower and hear in every bird-song. Christ fills the universe. His wisdom is enclosed in the atom and expanded in the starry world. Nature is full of interest when studied for itself alone, but infinitely richer when the glorious, gracious Maker is discerned in the works of His hands.

LECTURE II

THE NEW TESTAMENT IN ITS RELATION TO PHYSICAL SCIENCE

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IN its literary aspects, no writing having the same general subject—the revelation of the Son of God—could well be in greater contrast to the Old Testament than the New. The Old Testament in its poetry and its prose, in its biography, history, prophecy and song, presenting every form of literature and a perfect model in each,—has yet a deliciously antique flavour, and brings to our imagination a lively picture of the times in which it was written and the people whose grander features of character are indelibly stamped upon it.

The New Testament diction is more like that of our own age. It is simple, too, but its simplicity comes with larger sentences. The ample elastic Greek, with its musical lubricity, doubtless the most perfect tongue ever spoken by man—was the vehicle of the one;

while the stately Hebrew, majestic, intense, less copious,—was the voice of the other—the one magnificent in expression, the other marvellous in suggestion. So sharply contrasted are these great tongues, that our English versions retain their characteristics, and we, who are shut up to the latter in our reading, are not altogether unable to appreciate those qualities which the scholar doubtless sees better. Even to us, passing from the Old Testament to the New is somewhat like going from Stonehenge to St. Paul's Cathedral.

These two divisions of the Bible are strikingly different in their relation to the great theme, which both of them have in common. There is no part of religion that is neglected in either, but is it not true that in the older books the external side is emphasized, and in the later ones the internal side? In the one the foundation and growth of the Church, her lapses and their punishment, with her glorious future, are painted in vivid colours? In the other, the inner life of the believer, his growth in spiritual power, his trials and victories, his

falls and recoveries and his glorious personal destiny largely occupy the canvas. In the one it is the God of the chosen people whom we worship. In the other, it is the God of each true Israelite whom we love. This statement appears to be supported by the marked difference in the two Testaments as to the prominence given to the Third Person of the adorable Trinity. The Holy Spirit, the breath of the Almighty, is mentioned seventy times in the Old Testament, while in the New Testament covering less than one-third the space, He, the minister of grace and power to the Christian believer, is spoken of two hundred and thirty-two times. That is, He is named eleven times as often in the one as in an equal number of pages of the other. This fact makes a decided change in the standpoint from which man's relation to his Maker is viewed. In both Testaments, the spiritual and temporal are mingled. In the older one the spiritual looks at us through the temporal; in the later, the spiritual usurps the field of view and the temporal is often only seen at a second glance.

If, therefore, we are seeking for any light upon Christ's physical world in the pages of the New Testament, we are largely shut up to the possible relations of the world of matter to moral qualities. Let it not be thought chimerical to suppose that the material universe may have important bearings on ethical or religious growth. The pursuit of truth in Nature may be friendly or unfriendly to virtue.

But if Christ be the author of both worlds, they will surely not be discordant. We should expect the one to be in some realizable sense adapted to the other. To suppose that He would make the two worlds hostile one to the other, so that excellence in the one would be irreconcilable with proficiency in the other; or even that He would make them so independent of each other, that the phenomena of the one would have no sort of relation to those of the other, is a hypothesis so unreasonable as to be inadmissible.

We propose to inquire whether the qualities inculcated, especially in the New Testament, as characterizing the true disciples of Christ are such as best prepare one for, and are fos-

tered by, study of the other world, the material world, which He is declared to have made. Is the perfect man of the New Testament, the perfect man of science? If this is true, shall we not have a strong proof that the Bible is right in telling us that both came from one hand? On the contrary, should the traits of character fostered by scientific pursuits be unchristian, we must believe that the world material and the world spiritual have different authors.

What then are fundamental traits of Christian character as drawn by the Master Himself? Let us pick out only the brighter jewels from the full circle of gems. I would surely name first *Humility*, the basis of virtue, the indispensable condition of genuine excellence, the corner-stone of all lofty character. Like other precious things, it is often counterfeited. Mock humility is too common. True humility is rarer than it should be.

It is easier to say what it is not, than what it is. It is not servility. This cowardly trait, unlike humility, is often accompanied by great sensitiveness to supposed slights and by an

overweening self-esteem. Humility does not crawl abjectly before power or rank. It does not consort with cowardice or suspicion. It no more crouches before the insolent, than it tramples on the weak. The opposite of servility is tyranny: the opposite of humility is pride.

It is commonly said that pride grows out of an extravagant conceit of our merit or our possessions: while humility is based on a modest and proper self-estimate. Thus Mr. Spurgeon says that "humility is to make a right estimate of one's self. It is no humility for a man to think less of himself than he ought, though it might rather puzzle him to do that." After all, are not our estimates of ourselves or others always relative? We must have what scientists call a unit of measure. The proud man takes his unit too small. He looks beneath him for his measuring rod. The humble man looks up for his. We are exhorted in Scripture not to think of ourselves more highly than we ought to think. But it is not enjoined upon us to think ourselves base, for the apostle immedi-

ately urges his brethren to "think of themselves soberly, according as God hath dealt to every man the measure of faith."

But may it not be true after all, that the highest type of humility consists in not thinking of oneself at all? Have we not for this the highest authority?

"At the same time came the disciples unto Jesus, saying, who is the greatest in the kingdom of heaven? And Jesus called a little child unto Him and set him in the midst of them and said, verily I say unto you, except ye be converted and become as little children ye shall not enter into the kingdom of heaven." The Master does not leave us in doubt as to what trait in the child He meant to commend.

Poets and painters love to depict the beauty of the little ones, their artlessness, and innocence and their appealing helplessness. These are all lovely features of the infantile character. Through all the ages they have made the child the jewel of the household, the ruler before whom his elders bow as they recognize in him the spring of the gentler

feelings which the hard world outside ignores or represses. But it was not those beautiful appealing qualities which the Master wished to emphasize here, much as He loved them. He leaves us in no doubt, for He immediately adds, "Whosoever therefore shall humble himself as this little child, the same is the greatest in the Kingdom of Heaven." Startling paradox this as to the foundation of moral greatness. Whoever, before our Lord, thought of humility as characterizing a child? If humility means proper self-estimate this involves reflection and comparison, and these the child cannot exercise. They are the mental operations of mature life. But if humility in this highest form means absence of thought about oneself, the child has it perfectly. He does not take offense at what would be grievous slights to older people. The quip, the sneer, the cut are weapons powerless with a child. He does not understand them, because he is not thinking of himself. Humility in him is associated with weakness, but the association is accidental and unnecessary. Humility is not weakness. Strength

may stoop. Weakness must stoop. True humility may belong to the most mature and exalted character. An archangel may have it as fully as an infant. How perfectly was it exemplified by our Lord who emptied Himself to save His people, and though He was the son of God, rarely spoke of Himself as such, preferring, when He mentioned that august relation, to say that God was His father, and thus in that glorious duality, to direct attention to the other personage and not to Himself. Are we not right then in naming humility as the first and chiefest in the round of Christian virtues? A good Christian must that architect of the old English college have been, who, in arranging the quadrangles made the gate of honour only to be reached through the gate of virtue, while both were inaccessible except through the gate of humility.

Next to *humility*, we would place as a fundamental feature of a perfect man in Christ's Spiritual Kingdom, a very closely allied quality, *Simplicity*, or, as the apostle calls it, "singleness of heart." It characterizes the

loftiest natures and is so obviously necessary to a complete character, that it seems not to need or receive large comment in the Scriptures. Its opposite, duplicity or hypocrisy, however, is scourged repeatedly throughout the Bible. No form of imperfection is so terribly denounced by our Lord. "Woe unto you, hypocrites," came often from those gentle lips. His apostle declared that "the double-minded man is unstable in all his ways," and lifts up his voice in exhortation: "Purify your heart, ye double minded." Christ's forerunners had said that "the hope of the hypocrite shall perish" and that "his joy is but for a moment."

Near to simplicity in the garland of Christian excellencies, is *love of truth.* "Truth and sincerity," quaintly said Bishop Tillotson, "have all the advantages of appearance and many more." In short he means that they are indispensable to reputation as well as character. Christ made no account of reputation, but exalted character, and put truth as a primary and necessary part of it. Truth was not apparently valued by the peo-

ple of His time and race. The Saviour rises above the level of His generation in this as in other things, as the Matterhorn above the Zermatt hills. He exalts this trait by declaring Himself to be embodied truth. From that time on, to His followers, love of Him has been love of truth. Only scholars can love an abstraction, but all whether learned or unlearned, can love a quality realized in a living person. Pilate asked "what is truth?" and did not know that he had the answer before him, for he had never heard the memorable words "I am the truth." Millions since that time have found in Christ, a reply to the question which the Roman procurator evidently thought to be unanswerable, for he immediately retired after asking it.

We close, but do not exhaust our enumeration of the salient virtues of the Christian character, as drawn in the Bible, by mentioning the quality of *Faith*. Our doctors tell us that this, in spiritual things, is an active state of the mind, distinguished from mere belief, in that its object is a divine person and not a proposition. Doubtless it is

the acceptance of a divine person and his claims on us, involving intellect, conscience and will. We beg here to be allowed to refer to the intellectual part only of this complex act. In regard to this, we cannot do better than take the bold graphic description of it by the author of the Epistle to the Hebrews, who calls it "The evidence of things not seen," while the whole of it, intellectual and ethical, is the "substance of things hoped for." In this aspect then faith is the power to see the invisible. The paradox is only apparent. We see the things called visible with the eye of the body, but there is allegorically a mental eye that may give us pictures of the invisible more vivid, more definite than anything we see by the light of the sun. "The things which are seen are temporal, but the things that are not seen are eternal," and the latter make up the higher world. In it, without faith, we grope like blind men; with it, we walk in light and see Him who is the light. Faith is not contrary to reason. The things it reveals are beautifully consistent

and harmonious. They are reasonable in a high sense, but unaided reason would never have seen them. They are not unnatural, but supernatural, or perhaps better super-physical.

We have thus briefly picked out from the whole garland of graces forming the type of a perfect man, as revealed to us in the word of God, four that we regard as fundamental. Faith, Truth, Simplicity and Humility are the stones at the corners of the grand edifice of Christian character. If one asks, where is love? we say, love is the bright aura that fills the building and warms and glows in every part of it. We do not divorce the occupant from his home. Love believes, is true and simple and humble.

It is now our duty to ask, before passing to the other realm of the creation, whether these four primary qualities receive in other religions the prominence they have in Christ's scheme. There is a striking tendency in some foreign circles, copied as usual in certain localities in our own land, to press the claims of the great Oriental religions to

equality with and at times to superiority over, those of the Bible. A free field should be given to all honest admirers and faithful students of those venerable cults. The theme is too important to every human being to allow prepossession to bar the way to the truth. While we may not care to join a "parliament of religions," we want sincerely to know the best that Brahma or Buddha or Confucius or Mahomet has to tell us. Have humility, simplicity, truth and faith the vast and overpowering prominence in the teachings of any of these great leaders, which they have in Christ's words? Am I doing them any injustice when I say they seem to have little place and several of them no place for humility? Is it not with them a slavish quality, contemned and rejected? They appeal to fear often. The images set up for worship in their temples are rarely other than awful. Is it not true that the lowliness which may dwell in a brave and noble soul was a revelation for which they were unprepared? These religions may have much which we admire, especially in their leaders and

founders as distinguished from the great masses of their followers. Brahma was serene, Buddha severe, Confucius prudent, Mahomet temperate and brave. But none of them enthroned Love. Simplicity and Truth were admitted by some of them when useful. They exalt power, and praise "the superior man." Christ loved the poor and emphasized those unearthly traits which lift the poor man to fitness for the loftiest society. We believe that humility, simplicity, truth and faith, in the emphasis given to them by Christ, characterize the Christian ideal as unique among the religions of the world.

Are these indispensable qualities in Christ's Spiritual Kingdom recognized, or are they ignored in the constitution of the Physical World? Are these moral traits fostered by the study of material science, or are their opposites cultivated by such pursuits? Do these Christian virtues prepare a man for successful scientific work, or do they hinder him?

As I have said in another place[1] let us

[1] "Thoughts on the discord and harmony of Science and the Bible," Treasury of Christian Thought.

listen then first to the voice of Physical Science as she speaks in the lives of her greatest votaries and in her own teachings, and learn what are the qualities of heart which she requires of her children for entrance into her courts. Who is the perfect man, as viewed from *her* position?

I. The answer undoubtedly is that his first and greatest virtue is *humility.*

The scene that is presented to us in the material world is one which from time immemorial, by its vastness, has excited and oppressed the imagination. Even the childish views of the visible universe, to which the ancients were shut up, overwhelmed the contemplative with awe. "To count the stars, or measure the earth," was their synonym for an impossible task. The contrast between the greatness of the universe, even as imperfectly known to them, and the littleness of man furnished an obvious theme for the moralist and the poet. If such were the fact in the infancy of knowledge, how indescribably exalted is this contrast, by the knowledge of the universe which we possess.

David's starry dome, to him perhaps only a little way above the clouds, has been pushed farther and farther away, expanding more rapidly than the flying centuries, until in sober truth "its centre is everywhere and its circumference nowhere." The sun, which for him was doubtless no bigger than the moon, and but little further from us, has in men's conceptions retreated four hundred times farther back, and swollen in importance until it is eight hundred times as massive as all the planets together. Yet this superb orb, the Lord and giver of life and motion, from which planets and moons derive their mass, their light and their energy; this glorious shining sphere, which has been lavishing its treasure of heat it may be for many millions of years and has a store for as many more, is but an inferior unit among the hundred million suns which are doubtless within the reach of our greatest telescopes. This expansion in our views of the universe has left our earth immeasurably more insignificant than the speck it was once the fashion to call it. It is nothing. To mention it,

is grossly to exaggerate its relative importance.

The dimensions of time are no less vast than those of space. Geologists demand nothing less than hundreds of millions of years. While the physicist may not be prepared to admit these vast demands, he is willing to grant a duration which we may name, but can by no means grasp in thought. These reflections, the commonplaces of the schoolboy, so trite that they have lost their power to stir us, have been used from immemorial time to chastise the pride of man. "When I consider Thy heavens," sang David, "what is man!" How absurd in a creature, occupying a point in space and a moment in time, to strut forth in the presence of the silent infinities. The vastness of the universe rightly enjoins humility.

But while such is a legitimate use of this reflection, it is perhaps better suited to the early period of our lives and of the life of our race. Maturer minds are less impressed by these disclosures of the immensity of creation. For after all the numerical greatness of a

measured quantity depends on the size of the arbitrary unit one adopts. The fixed star, whose distance, when expressed in miles, stretches in unmeaning length across the page, appears to be brought quite near, when we take as a measuring rod the line which a ray of light describes in a year.

It will occur to the thoughtful that vast distances and duration should not oppress us. Numerical grandeur ought not to stun a rational being. It is not mere material extent which is best calculated to foster humility in a reverent and thoughtful soul. Fortunately it is not the things themselves with which we are most concerned, but the ratios of things. The things may be inscrutable, impossible or imaginary, and the ratios may be real and simple and quite comprehensible.

But is the physical universe exhausted when we have gauged its depth, counted and weighed its orbs, and measured its durations? By no means. Behind these facts of mass, and distance, and time lies the greater and better part of the universe. From the contemplation of these phenomena emerge

the nobler ideas of universal law, of cosmic order, of majestic force. In these we discover the great soul of science in whose solemn presence the greatest mind may bow as a child. Before the ineffable and awful beauty of truth, the shekinah of this sanctuary, the mature philosopher bends with a reverence which he cannot pay to the stones and beams of the temple. He may stand erect in the presence of the unfathomed abysses of space with their countless contents of varied splendour, but he must feel that he is a very little thing, when there arises in his soul the conception of the grand law by which this innumerable host is made a system.

The occasion and need for humility are greatly enhanced when from the general conception we descend to particulars. The contemplation of nature fills us with astonishment when we contrast the simplicity of her causes with the complexity of their results. Newton declares that "nature loves simplicity and affects not the pomp of superfluous causes."

The law of gravitation may be stated, and

comprehended by a child, but when it is remembered that each body in the universe gravitates to every other body, and in its movement must obey that influence, it is easy to see that the displacement of any one mass involves a complex which no human mind can unravel. What is true of gravity applies equally to other forces. Their operation is mingled hopelessly in the case of each body; so much so that the complete statement of any actual physical event is impossible. The younger Herschel is reported to have declared that if all the conditions of any physical question were rigorously written out the resulting differential equation would belt the earth. Were absolutely rigorous conformity to facts, however minute, demanded, there could be no science.

Mathematics can give us a rigorous solution of the problem of two particles only, subjected to the law of gravitation. Add a third and the solution is possible only under certain conditions, and then it is merely approximate. Yet there is no problem in nature so simple as the latter. What a lesson of

humility we have here! Place the intricacy of nature and the limited power of the human mind in juxtaposition and mark the disparity. Should a little child attempt to grasp a mountain, the effort would be less presumptuous.

How then have the triumphs of science been won? The answer gives still more cause for humiliation. It happens most fortunately that in the multitude of influences to which each body is subjected the greater part are insensibly small, and are for us practically non-existent. Of those which cannot be disregarded, one is usually large, and the rest may be considered as mere disturbances of it, which may be calculated separately, and added together, their joint effect being nearly equal to this sum. The solution, it is true, is imperfect and only approximate, but if the result differ from the truth by something less than one can measure, it is accepted as exact, because it is indistinguishable from the truth.

There are, however, very few physical problems which can be attacked in this high

mathematical way. In the great majority of cases one cannot begin at the beginning, but must seek by experiment to be set very near to the conclusion before the question can be put into a mathematical form admitting of solution. Experiments take the place of impossible integrations. In many problems of the highest interest, involving the ultimate constituents of bodies, we are forced to adopt what Maxwell calls the statistical method and reason by averages to results which become more faulty as the groups become smaller.

The whole region of science in its most exact form is thus a theatre of artifice and expedient. These are a confession of weakness. The scientist approaches his question as a hunter does his game. He watches and creeps and seeks vantage ground, and then mostly fails. Where is there room for arrogance and pride? The physicist must stoop to conquer, and must stoop very low. Surely of all the qualities demanded of the votary of science, the first and chiefest is humility.

II. *Simplicity.* By this I mean that sin-

gleness of mind which in conduct leads to consistency and in intellectual matters begets clearness of thought. Perspicacity is indispensable to the scientist. His experiments are questions addressed to nature. If the thought be confused, the question will be involved, and it may be that several questions will clumsily be asked at once. Now, nature answers everything that is asked of her, but if the inquiry be mixed and disordered, the answer will be so too, and although true, it will be unintelligible. For success in research the student must have a point to make and must make it. Such intellectual simplicity is the natural product of simplicity of character. Duplicity in morals may not always be joined with confused thinking, but they are natural allies. To follow two masters in morals leads often to a similar oscillation between truth and error in speculation. Such wavering is incompatible with progress in science. Nature is on the side of honesty, and sternly represses the false and the fickle. She has no pity for weakness, and towers above imbecility like a frowning despot, while she

yields with smiling grace to the strength which is begotten of simplicity.

III. Next to the foregoing fundamental requisites, and scarcely inferior to them in value, is *love of truth.* Such a love excludes prejudice and pride of opinion and party spirit. Where the latter exist, they operate on the intellect as shackles upon the limbs. The fields of scientific research are intricate and difficult while the powers of the explorer are feeble and limited. His task is hopeless if he begin his work handicapped or fettered. The cultivation of science often requires the sacrifice of ease, of taste, of fortune, of health, nay of life itself, and often of what to many is harder to bear than all these, the giving up the cherished opinions of a lifetime. As a reward for all these losses she offers only the truth. Nothing but a passionate love of the truth can ensure the noble choice.

The annals of science show that this loyalty to truth has characterized the great discoverers of our own and other ages.

I recall the instance of Newton, who, when the secret of the world was within his grasp

and nothing but a trifling numerical discrepancy intervened, paused for twenty years, patiently waiting for new light, at a time when other keen minds were on the same track, and he might any day have seen the crown snatched by another.

I may mention Baily, who, when by a long, difficult and delicate research he had accumulated records of one thousand three hundred pendulum observations, and a discussion of them revealed to him some unknown vitiating bias of a minute amount, did not hesitate to burn them all, though the act cancelled a year and a half of precious time. A less lofty intolerance of error would have sought to claim some recognition for these hard-earned results. Think of Darwin who worked and laboured in obscurity for thirty years to make sure of his ground, when a less conscientious man would have rushed into print with a brilliant but immature hypothesis.

Contrast with these examples the feverish haste with which struggling aspirants for fame hasten before the public with embryonic facts, which largely turn out to be abortions.

The freedom of the press is a great boon, but we pay daily for it a great price.

The corrective for this haste is a love of truth superior to love of fame. The love of truth is a wholesome restraint, much needed in this age of irrepressible movement and bold speculation.

But it is not only a curb, but a spur. It leads to industry in pursuit and patience under disappointment. These qualities are indispensable to success, for not only are the problems of science intricate, but she conceals the truth. It seems to be her glory to hide a matter. She makes no provision for carelessness or weakness or laziness. On the contrary the world appears to be so constituted as to lead these wrong.

If nature were to take human form, it would often be that of a beautiful coquette, delighting to mock her suitor, to deceive him and laugh at him. "She flies to the willows, but beckons to him as she vanishes." The protective mimicry of which naturalists tell us has its analogies throughout science, making it easy to err, and hard to grasp the

truth. The farther and higher the student goes, the more is he impressed with this. Sir J. Herschel, in a remarkable passage in one of his essays, refers to this fact. Speaking of what he denominates the two most difficult and delicate of physical problems—the parallax of the fixed stars and the mean density of the earth—he declares that in their solution "every element, nay even the elementary powers of heat, electricity, the molecular movements of the air, the varying elasticity of fibres and a host of ill-understood disturbing causes, set themselves in opposing array in their most recondite and unexpected forms of interference." This undoubted fact in the existing constitution of nature, need not trouble him who believes that the material universe is meant to be a school for the mind. A world without puzzles and disguises, where indolence and carelessness would be as safe and profitable as their opposites, might be a beautiful world. It would be worthless as a school. In the actual world of science then, love of truth is indispensable to the complete man.

Truth in nature challenges our love and our wonder by its richness and variety. In the light of advancing knowledge, the utmost power of invention and fiction appear to be poor in comparison with the sober facts of the world around us. Our childhood was stirred by tales of giants and dragons. Goethe exhausted his imagination and Retsch his artistic resources to depict the scaly forms with terrible claws and many a snaky fold at which we used to shudder. Yet the geological museum discloses actual forms of tremendous beasts, — Dinosaurs, Brontosaurs and the like, of such size and horrible combination as make the work of the poet and draughtsman seem poor indeed. The dragons of mythology are mild survivals in fiction of those actual monsters of the later geological eras. The facts of the world are everywhere far greater than our possible fancies. The greatest masters of painting and sculpture accordingly seek for models in all their work. They do not imagine clouds, but watch the sky. Whether it be the human face, or even the folds of a mantle, a

Raphael will not paint them from imagination or even from memory, but must have the living subject, or the actual drapery before him as he works. Truth is not only stranger than fiction, it is far richer. Nature stretches on all sides in endless vistas. What we have seen is but a small part of what remains to be seen. End there is none, we cry. The same cry will be heard ages hence, when in the advance of knowledge our widest learning now will seem to our remote successors the merest and crudest beginnings of a vaster science. Truth should be loved because, like God, it is infinite.

IV. Next to these three, and finally, the moral quality most urgently demanded of the scientist is *Faith*, or a capacity to believe that for which there is evidence indeed, but no immediate sensible evidence, and to act on that belief. The cold intellectual constitution, that demands demonstration before assent, is an effectual bar to scientific progress. When we enter the field where action must be based solely upon preponderance of probability and demonstration to the limited extent

that it exists at all is solely destructive, the moral character of the student will have a great deal to do with his intellectual movements. We call the height of conviction here "moral certainty," the only kind of certainty we can have as regards positive statements, either in the domain of conduct or in that of the sciences of observation or experiment.

Scientific research has taught us that the ultimate materials of the physical universe are hopelessly beyond the reach of our senses, however these may be aided by instruments. What is seen is made up of what is unseen, and derives all its properties from it. The electrons, forever invisible, may be the efficient units of the visible world. In the insensibly small spaces surrounding and separating these material points, the forces operate which determine solidity and fluidity, which generate the marvels of light and heat, and constitute the secrets of electricity. The triumphs of modern science have been largely won in this unseen world, where he who walks, walks by faith and not by sight. No one can

enter here who is not prepared to accept and realize the invisible. His ability to thread his way in this, the real though hidden, universe will depend not only upon his imagination or power to "visualize" the atomic figures and swings (for this may mislead by its too clear definition), but upon a healthy discrimination between that which is essential and that which is unimportant, and a hearty confidence in the former. Surely then modern physics, whose highest studies are thus conducted in a region beyond cognizance of the senses, demands and cultivates in its votaries the faculty of realizing the invisible.

This will appear yet more clear if we look a little farther into recent science. Bodies and their atoms form but a part and that not the most important part of the universe. The latter is made up of two things: matter and energy, or power associated with matter. This power is inexpressibly fugitive. Bodies and atoms are incessantly exchanging it with one another. These transfers constitute the events of the material world. All that happens to bodies, their motions, changes,

effects on our senses, are the result and signs of transfer of energy to and fro. A world whose energies could not be thus transferred from one member to another, would be exactly like a world void of energy, dark, silent, motionless, dead. Energy is therefore the great direct subject of scientific study, and matter is only indirectly known through energy.

The closeness of the association between matter and energy is suggestively shown by the fact that the laws of energy are identically repeated in the laws of matter. Thus there is a law of transmutation for each, a law of conservation for each, and a law of dissipation for each. It would not be wrong to say that physical science is the science of energy. Yet energy is wholly invisible. If in the realm of matter where a part is visible, science cannot perceive without faith, much less can she do so in the greater realm of energy, where all is invisible. This faith, like all genuine faith, is in harmony with reason. Science judges of the things that are unseen by the things

that do appear. When she emerges from the world of sense into the world beyond sense, her steps become more confident, and she advances with an elastic freedom that shows that she is in her native element. The laws of the invisible world of Physics are better known, its phenomena are simpler, and its conclusions are more certain than those which refer to the visible world. For in this invisible world we more easily ignore the multitude of vanishing but confusing agencies which press upon us everywhere in the world of sense, but which are more readily ignored and therefore do not trouble us in the unseen universe.

The physics of the invisible has received a mighty contribution in the past decade. In that time, a new department has been created called *radio-activity*. As we have before hinted men have been brought to know that the invisible molecules of which bodies are composed, possess an amount of energy heretofore incredible. It appears that some, at least, of them are descending to lower and more stable forms, giving

off meanwhile incessant radiation—partly streams of matter projected with amazing speed, and partly ill-understood emanations of remarkable character, with radiant energy beside it may be in the shape of waves. The whole of this complex activity, together with the sum total of the matter involved in it, is of a scale of minuteness, which is inconceivably small in view of the power manifested. No balance or chemical reagent has seized these shadows.

The investigations of the philosopher here deal with what seem to be "the ghosts of departed" masses, which cannot be handled with our ordinary implements of research. In this invisible region, near the very beginnings of all material objects, we need an eye for the unseen—faith hand in hand with reason. It is not too much to say that the scientific world to-day has its attention largely engrossed by the study of radio-activity. Men have turned from the pursuit of the vast problems of the heavens, the inexpressibly grand,—to concentrate attention on the opposite pole of creation, the in-

expressibly small, and have in these last years gathered what has perhaps somewhat rashly been called "the new knowledge." This novel field is believed to hold the key to the material world, and it is of a difficulty demanding powers given to but few; but their results are breathlessly awaited by the onlooking crowd of teachers and students. Great revelations are doubtless just ahead of us—great changes, if not reversals, in our atomic theories, but the essential conditions for making these discoveries and of understanding them when made is the faculty of seeing the invisible. We are right then in emphasizing as a fundamental quality required in a scientific man, and fostered by his pursuits, that of faith in the unseen.

We see then that the perfect man according to the New Testament is humble, simple, true, and believing. The perfect man according to science is humble, simple, true, and believing. The voice of Nature is the voice of Christ. Are the two systems independent of one another, or do they belong to one system with one Head? The Bible offers the only

explanation of the coincidence. The whole scheme in heaven and earth is one. Nature and grace are in some humble but real sense complementary. They are two provinces of one kingdom. Truth is Christ's, whether in the realm of matter or of spirit. He who does good work in any realm, really does work for Christ. It is thus that even His enemies must work for Him, so far as their work is good. The old stone mason at Cologne, putting blocks into the rising wall, might have been an unbeliever, but he was helping to raise the great Cathedral if he did his task well.

The Christian view of the world sheds light upon another dark point. While Science demands of her votaries the great cardinal virtues of Christianity, and while it cannot be denied that the profoundest culture of nature fosters these virtues, yet we do not discover in her system any energy by which they can be created where they are not, or substituted for their contradictories, pride, unbelief, love of error or insincerity. In Christianity this very thing is done. She claims and shows a

power which nature does not pretend to have. If nature be an independent kingdom, here is a confessed imperfection. If she be a part of one kingdom with Christianity, the imperfection does not exist, for it is supplied in the constitution of the realm to which she belongs.

In closing we shall reply briefly to two obvious objections to these views:

1. "The qualities enumerated do not seem to be necessary to scientific achievement, for many scientists of fame are arrogant, sceptical and lovers of their hypotheses more than lovers of truth."

We reply, So are many professed Christians. If the faults of Christians do not disprove the Christian scheme, the similar faults of scientists do not contradict the tenor of science. We should judge of both schemes by their best types. I aver that the profoundest scientists are humble, and truth-loving.

2. "If the above views are true, Christians should make the best scientists," says the objector, "and this is contrary to ex-

perience." We admit the inference but question the assertion of fact. Let us remember that science is concerned immediately with the intellect, and that moral qualities, alone, however important, will not make a great scientist.

The history of science reveals to us in its leading votaries, many instances of the union of high Christian qualities with great merit as philosophers. Every Christian land has furnished such examples. Our own country could supply instances from every section, illustrating the support which religion and science may mutually offer in the genesis of a noble character.

I shall however select four men from "our little mother isle" as the genial "autocrat" calls her; men who, by universal consent, were at the very front of Physical Science and who, at the same time, were devout Christians. The contemplation of such characters, in which Christian excellence was incarnate, is fuller of stimulus to the observer than hours of mere disquisition.

Four figures (to speak only of the dead)

rise before us of supereminent stature among English philosophers of the last century. Brewster, Faraday, Stokes and Clerk-Maxwell, form a group of remarkable interest, of widely different mental gifts, but alike in moral excellence.

In the department of light, in which the nineteenth century witnessed remarkable advances, no name, among experimentalists, is more distinguished for the number, variety and importance of his observations than *Brewster's*. He had a harsh and rugged discipline in youth, and to the world his manner often conformed to his training. His doughty, trenchant way of dealing with his opponents and critics may be largely attributed to the influence of his early conflict with poverty. Yet beneath the rough exterior was a loyal loving soul. In old age, as so often happens, his Christian character developed in tenderness and charm. Few narratives are more delightful than the one which we owe to the filial piety of his daughter, Mrs. Gordon. Standing by his death-bed she said to him:

"You will see Charlie."

Gathering himself, he answered after a pause:

"I shall see Jesus, who created all things —Jesus who made the world—I shall see Him as He is."

Under a sculptured window of "Fair Melrose" Abbey, in a white marble tomb, sleeps the mortal form of this great philosopher. On the base of the tomb is this legend: "The Lord is my light."

Sir George Gabriel Stokes, Lucasian Professor of Mathematics in Cambridge University, renowned for his beautiful experiments in fluorescence and in binocular vision, and scarcely less so for his masterly writings in Mathematical Physics, was singularly gifted as a teacher for the brightest minds. His fame is scarcely more surely founded upon the publications he made, than upon the pupils he taught who became later distinguished in science. Men like Kelvin, Maxwell and Tait, delighted in after life to acknowledge their debt to him. They omitted no chance of profiting by his counsel

and of claiming for him priority in discoveries, when he seemed too modest to claim it for himself. This eminent man delighted to acknowledge his Saviour. We may discern his influence in the decided Christian character of his famous pupils, who owed him a great debt, not only for the great intellectual stimulus he gave them, but for moral uplift as well.

Sir George Stokes was an active member of the Victoria Institute, a society founded in the interest of anti-sceptical science. For years he took part in its work and his adhesion constituted an important part of its capital. He gave the Gifford lectures in 1891 and his subject was Natural Theology. He also delivered in 1887 the Burnett lectures, choosing for his topic *Light*, and treating it as a Christian philosopher might do. He died in the maturity of his powers, after a long life of service.

Of Clerk-Maxwell, his celebrated pupil, who died when still comparatively young, but who left a name which will live forever, —we are at a loss whether to admire the

most his attractive personality and charming traits, or his brilliant professional labours, and strikingly original powers. He was a conspicuous example of the need and value of incessant industry, if uncommon mental gifts are to achieve lasting results. He undertook to interpret Faraday to the Mathematical world and in the attempt created a new department of Physics. He too was always a reverent devout believer of the Bible, honouring the Lord. He closes his celebrated essay on Molecules with an expression of his faith in Him, "who in the beginning created not only the Heaven and the Earth, but the material of which Heaven and Earth consist."

Michael Faraday was the son of a blacksmith. He was born in a blacksmith's house and died in Hampton Court palace, where he had residence at the Queen's request. It is harder to rise in England than in this land. Only those of very superior worth can overcome the barriers which distinctions of rank, recognized by law and usage, have set up not only in society, but, by its pervasive in-

fluence, in all lines of human effort. Merit must be great to overcome low birth, but if great, it will overcome it in grand old England.

Faraday was born in Surrey near London, in 1791. His father was a stout Yorkshire man, who while he plied his hammer, meditated on the Bible and doubtless, as stroke followed stroke, fancied that he was striking error at every blow. His mother, from whom we imagine that Faraday got his genius, is little known in her quiet life. She must have been a noble woman, for her great son, amid his rising honours, never ceased, while she lived, to show her a devoted affection. It is natural to love our mothers, but common men often grow ashamed of them, when wealth and honours are won. Faraday never blushed for his humble origin, nor on the other hand, did he ever vulgarly obtrude it. On proper occasions he would modestly own his liking for the forge and anvil, saying in explanation, that his father was a blacksmith. He reminds us, in this, of that other great Englishman, Dr. Samuel Johnson,

whose affectionate letters to his mother as long as she lived, do him more honour than the Rambler, and will be tenderly recalled when Rasselas ceases to be read.

Faraday, in boyhood, naturally had the narrowest opportunities. He says: "My education was of the most ordinary description, consisting of little more than the rudiments of reading, writing and arithmetic at a common day school. My hours out of school were passed at home and in the streets." He is next an errand boy carrying newspapers for a bookbinder; then an apprentice to him—reading the books he was learning to bind. His mental activity thus aroused, showed itself in ways that were sometimes ludicrous; as when he got his head through the bars of a fence, and in his struggles to get free, tried to solve the problem "which side am I on?"

Sir Humphry Davy was then lecturing at the Royal Institution. Faraday was lucky enough to get tickets for four lectures. He took notes, neatly transcribed them, and sent them to the great chemist. Sir Humphry

was struck with their merit, and, being a gentleman, immediately acknowledged his letter. Two months later he made Faraday his assistant.

The youth's progress was now rapid. Yet it is not astonishing that the elegant, famous, fashionable and highly connected professor should not discern in the blacksmith's boy and bookbinder's apprentice, the future leader of the science of England, to whom he himself, should he live, would look up, not down. He went with Sir Humphry and Lady Davy on a visit to the Continent, and sometimes acted as a valet for the great man.

No wonder then, that in 1823, when at the age of thirty-two, Faraday was proposed as a member of the Royal Society, his patron and superior opposed his election. It should be said that Davy soon abandoned his doubts, acquiesced in the election already made almost unanimously, and gave the young philosopher assurance of his esteem and friendship.

It speaks still more for Faraday that the episode left no wound in his spirit. Twelve

years later he said, "Whenever I have ventured to follow in the path which Sir Humphry Davy has trod, I have done it with respect and with the highest admiration of his talents, and nothing gave me more pleasure in my last paper than the thought that . . . I was able to support the views advanced twenty-eight years ago and for the first time by our great philosopher."

His connection with the Royal Institution began in 1813 and ended with his life in 1867. It was made memorable by the greatest series of scientific discoveries that have marked any half century in the history of our race, all due to this one man.

The practical application of his discoveries makes up a large part of the mechanical wonders of this age. The entire field of electrical invention—telegraph, telephone, electric lighting, locomotion, and transmission of power began with his discoveries seventy-five years ago. Not only so, but his later researches led to a complete revolution in the theory of electricity. Faraday led

to Maxwell, Maxwell to Hertz, and Hertz to Marconi, and thus to telegraphy without wires.

Faraday's failures even were sometimes fruitful. One experiment of his made in his seventieth year and rendered abortive simply by lack of a sufficient instrument, repeated by a successor (Zeeman) more fortunately situated, has given to the latter worldwide fame.

The English lad, who in 1800 was playing marbles in the streets of London, had made his chief discoveries before he was fifty-five years old. From an early date, honours were poured upon him from foreign lands. His own government offered him a pension. Though he was poor, he declined it. Mercantile houses sought his alliance. He would not listen to them. Men were making fortunes by using his discoveries. He did not disparage commerce and money-making. But he had no time for it. He had chosen another calling, and would not mix the two. He not only declined wealth, but he declined social rank. He might have

been a Knight or Baronet. He preferred to remain poor and untitled. Noble man! When rank and wealth shall be forgotten in the long ages, your diadem will shine with increasing brightness.

Faraday did not spend all his time in research. At intervals he appeared in the theatre of the Royal Institution as a lecturer. Perhaps he enjoyed most of all his Christmas lectures to children. The simplicity and crystal clearness of his expositions, the freshness and felicity of his experiments, charmed and instructed not only his juvenile hearers, but the learned men in his audience. He was in body small, though not feeble; of singular alertness and quickness of movement, with a bright unresting eye, and of remarkable dexterity in his manipulations.

He had the mauvaise honte of many Englishmen of renown. Mr. Vincent, Librarian of the Royal Institution, delighted to show visitors how Faraday would trot into the lecture theatre, where a distinguished company had assembled, and not seeming to notice them at all, turn to his assistant and

make some remark about the fire in the grate and then about the subject he had to speak of, facing about to his hearers while doing this and thus imperceptibly gliding into his lecture.

We have given a slight sketch of Faraday, the philosopher. There was another side to this great man.

He was a devout Christian and, for a while, a preacher of the gospel. His father and grandfather had been members of a small sect cut off by Robert Sandeman from the Presbyterian church, but retaining the cardinal doctrines of that religious body. Young Faraday was strictly brought up and with his parents was every Sunday at the Sandemanian meeting house. Being trained up in the way he should go, when he became old, he did not depart from it. As he grew up in due time he was admitted to the communion and afterwards was elected an elder, which office carried with it the duties of a preacher. Accordingly on Sunday, he would often be found in the pulpit. There was a striking contrast between the minister in the sacred desk, before

a company of humble people, and the great philosopher behind the lecture table of the Royal Institution, with Prince Albert and a crowd of richly dressed ladies and gentlemen listening to him. He never spoke of electricity in the pulpit, nor did he in words mention the Bible in his lectures. This was of set purpose, and in conformity with the teaching of his Church. The best spirit of his science in conscientious care and exactness characterized his sermons, and the spirit of his religion in its gentleness and winning address and unselfishness, marked his lectures. Faraday seemed to feel that there was a temptation to a scientist in speaking of religion to make science the master and not the servant as it should be.

One who saw him in both spheres thus contrasts his manner in the church and in the lecture room. "The overflowing energy and clearness of the professor," says he, "were replaced in the pulpit by an earnestness of manner best summed up in the word devoutness. His object seemed to be to make the most use of the words of Scripture and to

make as little of his own words as he could. Hence a stranger was struck first by the number and rapidity of his references to texts in the Old and New Testaments, and secondly by the devoutness of his manner. His sermons were always extemporary but they were prepared with great care. No one could lecture like Faraday but many might preach with more effect."

Faraday justified his exclusion of science from sermons. "I shall be reproached," said he, "with the weakness of refusing to apply those mental operations which I think good in respect of high things to the very highest. I am content to bear the reproach." "I claim an absolute distinction between religious and ordinary belief." "Yet," he adds, "even in earthly matters I believe 'that the invisible things of Him from the creation of the world are clearly seen, being understood by the things that are made, even His eternal power and godhead,' and I have never seen anything incompatible between those things of man which can be known by the spirit of man that is in him, and those higher things con-

cerning his future which he cannot know by that spirit." Nature is no substitute for God, but may be a helping image of Him.

Here I have inadequately drawn for you a noble life, worthy in many points of the imitation of any young man. The qualities that shine forth in him most lustrously are his humility, his simplicity, his love of truth and his extraordinary power of seeing the invisible. These are qualities emphasized both in the Bible and in Christ's record in Nature. Faraday was a great scientist and a great Christian—far above the mass of men in both characters, and a convincing witness of the truth that Science in her highest form does homage to our Lord.

LECTURE III

SCIENTIFIC HINTS IN BOTH TESTAMENTS

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IN comparing the records which Christ has given us in His word and His works, it is wise for us to remember that it is *our interpretation of them* which we are handling. There are two sciences in question, that of Biblical Exposition—Hermeneutics—and that of the Physical World—both human sciences—both incomplete—both growing. Of the two, Biblical interpretation is far more mature and advances with far slower steps as the ages roll on. Yet it is delightful to believe that the treasure house of sacred learning has many gems yet undiscovered by us, and that future centuries will reveal riches in God's word now unsuspected by His servants.

Especially will this be true of passages which require for their complete comprehension a knowledge of external nature which is

not yet possessed and may not be ours for long years to come. For contrasted with our knowledge of the Bible, our acquaintance with Nature,—our Physical Science as we term it,—is lamentably immature. To the greatest minds, we seem to be working still in the selvage of science. The unknown seems vaster to us than it did to our fathers. Our painful climbing widens the horizon of the unexplored and makes our growing attainments seem relatively more and more insignificant. Growth consists in discarding the old while taking on the new. Science advances by "trial and error." The next age will use the knowledge of this one and largely abandon it. Our theories serve their purpose, helping us forward and then are forgotten.

In this condition, apparent contradictions between the Bible and science should not alarm us. Such contradictions often occur in other human sciences, as when geology needs five hundred millions of years, and physics can only grant a tenth of this. In such cases we wait and work and keep

unruffled, till improved knowledge removes the discrepancy.

Nor should apparent harmonies between Scripture and Nature unduly elate us. The reconciliations of a former generation seem to us now sometimes puerile. Advancing knowledge of Nature, still in its infancy we must believe, while rendering obsolete some old time view of the meaning, earthward, of some Scripture passages, has given to many others a significance and a wealth of precious suggestion heretofore unsuspected.

The Bible thus becomes richer in meaning as our knowledge of the world around us grows. In its inner and higher life, it has to do with what is independent of time and space, and in that aspect it is ever young. Unaffected as it is, in this its greatest sphere by the progress of human science, it may yet in many delicate expressions and illustrations, have needed light thrown on the higher world by the analogies and harmonies of the lower world. As the Bible uses these parallelisms between the two in metaphor, and parable for the elucidation of its great theme,

are we not justified in pursuing our inquiries still further in order to find images of the invisible world in the visible world about us?

These considerations—namely the immature and partial character of our knowledge of the material world, and the present rapid advance of that knowledge, quickly making obsolete much of what was held to be tentatively true in the recent past,—should expel dogmatism and make us humble and modest in assertions regarding it. There is however something which is settled in science. There are some principles which are established, and many facts in which the only change brought to them by the Science of the future will be to move them by emendations, growing smaller and more difficult as the years go on, to a closer proximity to the truth. As regards the rest of Science, in the theories held provisionally of various lines of phenomena,—they are the scaffolding of the building—helping to complete it and so to assure their own abandonment. In these speculations, we have only bad photographs of the real world —mental pictures of what philosophers as-

sume and believe the world to be—often very inadequate and distorted representations of the actual world, the true picture of which is in the mind of its Maker.

In view of these facts, we shall present to you some thoughts regarding the relation of Science to the Scriptures, without dogmatism or positiveness and with submission to scientific authorities in various departments. While we believe the views which we shall present to be just and well founded, so far as our present knowledge goes, we would still hold them, with a willingness to see them superseded by a truer, better knowledge which coming years may have in store for us.

We have before remarked that the references of the Bible to physical nature are mainly of two kinds—one including a few direct positive assertions about it, fundamental statements which we must believe to be true, if they are the word of God. Some of these we have already studied. Another class of these references is designed purely as illustrative, and therefore of necessity used the science of the times and its philosophy.

There remain, however, in both Testaments, after these passages are removed, occasional sentences where the reference to nature is often not apparent—or if suggested now was not understood until perhaps the progress of science revealed in them a meaning, not seized by those who first heard them, nor by any reader in the long line of centuries since, and only seen by us in these last days. So there may be passages whose full significance is hidden from us but will be appreciated perhaps ages hence by our successors, when future science has lighted up what is now dark. There are such utterances in the Bible which we may well believe did not appear to the prophets who wrote or spoke them, as they do to the humblest believer who now reads them. May it not be, that those sentences of expanding meaning, came through the lips and mind of a prophet from a higher Spirit in whom was all knowledge, and who filled and guided the former? It is to some of these scientific hints in the Scriptures, so marked and clear to some,

that they cannot be thought accidental, that I wish to ask your attention.

LIGHT BEFORE THE SUN

The first chapter of Genesis contains a statement that has always appeared most strange. On the first day, God is declared to have created light, while it was not until the fourth day that He made the sun, moon and stars. Thus the creation of light preceded that of luminous bodies. Immemorial experience, without exception, teaches us that to have light we must somewhere have a self-luminous body. Our light is gone when our lamp goes out, and does not reappear until it is rekindled. Day begins with the approach of the sun to our horizon and night comes when he retires.

It may safely be said that no human composition would contain what would in the line of experience be so obvious an error as reversing the order of nature and putting the effect light before the cause, the sun. Believing this to be no human composition,

commentators in all ages have sought to guess the meaning of this paradoxical statement at the very opening of the sacred writings. These guesses appear to be usually most inadequate or fanciful.

A widely prevalent speculation of former times, upon which perhaps the majority of Bible readers once settled, was that the sun, moon and stars were really created on the first day, when light was commanded to appear, but that enveloping clouds hid their forms, and only allowed an indefinite illumination to stream through them. On the fourth day, the mists were cleared away and the bright luminaries were first seen from the earth. Among comparatively modern Exegetes, I note Lange (1869) who declares "without doubt, the meaning here is not merely a light-phenomenon, which goes forth out of the background of Heaven and breaks through the dark vapours of the earth or from heavenly clouds of light (such as the primary form of the creation may have appeared to be) but an immediate lighting up of the luminous element in the earth itself,

something like what the Polar light gives rise to in the Northern Aurora." Somewhat less Teutonic is the writer in the Pulpit Commentary (1881), who believes that "the creation of light was in reality the evolution from the dark robed seething masses of our condensing planet of that luminous matter which supplies the light."

A better conjecture in the eyes of the physicist, was that of Richard Watson, who living at the time of the revival in England of the wave theory of light thought that the creation of the first day was of the Undulatory Ether; the preparation for light without which the sun could not shine for us. Yet we know now that Light is Energy, and the Ether is not Energy, but merely its vehicle; and so the conjecture of that eminent theologian fails to satisfy us. The progress of science since Watson's time would give his keen intellect, were he living now, a better view.

Modern science tells us that light does not come from the sun as its source. The energy we receive from his rays did not origi-

nate with the great orb. The sun and stars, like our artificial lights on earth, merely give us what they have received. They are only transferrers and transformers of an energy they did not create. The power contained in the light was in the world before the sun or stars began to shine. That active energy in Nature is everywhere the liberated form of great stores of dormant power, which we call potential. This latter is locked up for instance in fuel and food, and in every collocation of matter which is in strain.

When God said "Let there be light," may it not be that He spoke into being that vast treasure of potential energy in the universe connected perhaps with universal ether, which has been the capital used for its transactions ever since? Light is the highest, subtlest form of the great treasure when it passes into activity, and so may be a name for it all.

The subsequent creation of sun and stars would only be the introduction of the mechanism by which this precious capital has been localized and transformed and radiated so as

to serve the purposes of vision. If this be so, this Scripture is living truth to us, filled with a wisdom which was four thousand years in advance of the time when it was written—and, this paradox like all paradoxes of real knowledge, is removed by the removal of our ignorance concerning its subject.

THE INTRODUCTION AND PROGRESS OF LIFE ON THE EARTH

The first chapter of Genesis tells us, as we know, not only of the origin of matter and energy, but also of the beginning and development of life on the earth. The interpretation of these simple massive sentences, up to a time within the memory of living men, was strictly literal. The days were taken to be our present days of twenty-four hours. The act of creation was interpreted to be a sudden exhibition of omnipotence, bringing to pass the event in an instant of time. This exposition however was not universal.

A century and a half ago, a hundred

years before the publication of Murchison's Siluria, a great naturalist and engineer of Sweden, who afterwards became a great religious leader, Emanuel Swedenborg, held the view, we are told, that the early chapters of Genesis were purely allegorical and not historical, thus meeting and setting aside the skeptical criticism of a later time. The geological discoveries of the nineteenth century were hailed in their very inception and immaturity as wholly inconsistent with the Biblical narrative. I would call to your attention the fact that several of the ablest of these scientists, like Murchison abroad and Dana of our land, upon a review and estimate of established facts, did not feel obliged to abandon the Bible. Living men can recall the glowing sentences of the Scottish geologist, Hugh Miller, as he depicted the vision of the past history of the earth from its creation, caused by divine power to pass before the mental eye of the inspired writer of the first chapter of Genesis,—vast periods being compressed into days, and the rehearsal being like a

moving picture of creation. I do not propose even to mention the various interpretations which have in time been offered by ingenious men of learning and piety with regard to these primitive records. Perhaps we are not even yet advanced enough to decipher them. Perhaps the advancing knowledge of the earth, and the improved knowledge of the Bible as well, will in some future age shed a great and satisfactory light on this celebrated ancient geogony. Meanwhile I wish to point out a feature of it, which seems to me to demonstrate its superhuman origin.

The Scriptural account of the evolution of life under the inspection and power of the Deity, is so strangely different from popular thought even in later times and certainly in the days when these documents were written, and so like the teachings of present day science, that it is incredible they could have been written by unaided human wisdom. The sacred writer declares that the first life was vegetable, the next marine, next birds, then terrestrial beasts, closing in the appearance of man. The modern geologists affirm that

the earliest stratified rocks contain no undisputed animal fossil forms, but they do have undeniable evidence of the existence at the time of plants, probably in very considerable amount, considering the quantity of graphite, iron oxides and limestone that are the signs of vegetation.

Then in immediate sequence stratigraphically, come the Palæozoic rocks, filled with evidences of marine life passing from simple forms up to fishes and aquatic reptiles. The latter are followed by amphibious forms, and these give place to terrestrial reptiles—presently putting on avian characteristics, capable of flight, with membranous wings and later on feathered tails, becoming bird reptiles and finally reptilian birds, until they graduate into true birds, monarchs of the air. Then the four footed beasts appear, and these at last make room for lordly man, the last and highest of earthly forms.

Such is the sequence of life in the story of the rocks. Such is the sequence of life in the sacred record. Contrast with

the simplicity, the clearness, the scientific parallelism of the Biblical account, that of the so-called Babylonian Creation Tablets. Their utterances are nebulous and vague; often so obscure that one may find in them what he brings to them. One of them makes beasts the first creation, another of them puts man at the beginning—and their order is both incomplete and unscientific.

Now an observant writer three thousand years ago, might have imagined that plants preceded animals. He might have noticed that at the last analysis all animal life is supported by the plant, and so have assumed that the vegetable kingdom appeared first, but such a writer would doubtless have introduced in immediate succession the land animals whose needs led him to this assumption. Yet in geology long ages intervene. Again what man in a former age would have dreamed that birds came after reptiles and from them and that they in regular succession followed these marine forms? Sixty years since even geologists called the reptilian tracks of the Portland red sandstone, bird

tracks; "ornithichnites." Even they at that time had no suspicion of the truth.

The writer of the first chapter of Genesis shows a correspondence not with the science of his time, but with that of three thousand years later, which the accepted doctrine of probabilities makes it impossible to attribute to a fortunate guess.

A LIVING SACRIFICE

A very significant passage of the New Testament is that wherein St. Paul exhorts his Roman brethren by the mercies of God to present their bodies a living sacrifice which he declares is their reasonable service (Romans 12 : 1).

A sacrifice is not complete without the death of the victim. Were the latter to live, there would be no sacrifice. The knife or the flame must complete its work. A living sacrifice seems at first glance to be an impossibility. To the Christians addressed, the words must have conveyed a startling paradox. How life and death could be true at the same time of the same being must have

been hard for them to see. It was easy to see that life and death succeed each other in endless alternation. Life follows death as surely as death follows life. One thing dies that another and perhaps a better may live. The apostle in another epistle powerfully uses the dying of the seed and germination of the plant as figuring the resurrection of the body. Poets and orators from time immemorial have availed themselves of this fact of universal experience, which repetition never seems to stale, for death, however common, is never trite.

The passage in hand involves a different thought,—that life and death may be coexistent in each individual. The science of our time gives to this Scripture, we venture to believe, a new force by an analogy which we cannot but feel was in the mind of Him from whom the phrase first came.

Our friends, the biologists, tell us that a living being, animal or plant—such as those we know best—is a unit indeed but a highly complex unit, with special organs devoted to special uses. All these organs, when in

health, are coördinated and help to a common end, the welfare of the individual. The organs themselves are wonderfully complex; reducible to tissues, and these in the last analysis to cells. The striking fact is that none of these tissues are permanent. All are changing more or less slowly and at any instant their phases present all possible varieties of advancement or retrogression. Many are increasing, many are decreasing; all are changing. There are two great processes in life—the change which is a rise, and the change which is a descent. It used to be a popular conceit, that the human subject changes so, that after seven years no atom of the body remains the same. Recent authorities assure us that with regard to the larger part of our mass, a few months suffice for a complete renewal. Our life then is a constant movement of damage and repair; growth and decay; life and death. We live daily and we die daily, if death be cessation of function. The ratio of these simultaneous processes of regeneration and degeneration, may, in a rough sense, be said to determine

the date in the life-period at which an individual has arrived. When production exceeds dissolution, he is advancing towards maturity, to be reached when they become equal, and to be followed by the coming of old age, when decay predominates.

Our conception of this complexity of changes, called living, is vastly enlarged, when we are told that the condition of living is one of unstable equilibrium, kept from overthrow by the incessant interference of the guiding principle of life, just as a moving bicycle is maintained erect by constant minute arrests of incipient falls by the rider above. The whole fabric tumbles when life is withdrawn. While it is present, its victorious office involves a struggle in which a multitude of other living points, called microbes, are arrayed as enemies or friends. These innumerable changes no more affect identity, than substitutes replacing the soldiers falling in battle affect the identity of the regiment. Death is as inseparable from life in nature, as one end of a line or one face of a leaf from the other.

The apostle's metaphor shines out to us now with new force and meaning. It is, as if he said, "Your earthly life is a living sacrifice; you are dying daily, that you may live. Let it be so with these same bodies, as to your spiritual life." Some things must be abandoned that other higher things may keep on rising. Such is the history of every noble life. It sacrifices love of pleasure, love of ease, of honour and applause, that upon them may rise love of man and God.

Death then does not seem to have been regarded by the saints as an evil. To the Christian it finally is only, as a great preacher terms it, a passing through a veil, a very thin veil, into an adjoining room. To the apostle it seemed in a high sense to be the inseparable condition of life, and therefore with us always: so that perhaps what one calls death, others may call life, just as sunset to us is sunrise to another continent.

THE LAWS OF ENERGY IN CHRISTIAN LIFE

Among the undesigned, and therefore peculiarly impressive, hints of fundamental

physical law which we occasionally meet with in the Bible, none have appeared to me to be more remarkable, than a sentence of St. Paul's in his letter to the Philippians (Phil. 11, 12). It is translated thus in the "Twentieth Century New Testament":

"Therefore, my dear friends, as you have always been obedient in the past, so now work out your own salvation with reverence and awe and that not only when I am with you but all the more now that I am away. Remember that it is God who, in His tenderness is at work now that I am away."

This version is much closer to the meaning of the original Greek than that of King James, or even that of the revisers of 1884. Yet several delicate points are almost of necessity lost in the translation, especially in that part of the sentences which I wish to bring forward.

τὴν ἑαυτῶν σωτηρίαν κατεργάζεσθε, θεὸς γαρ ἐστιν ὁ ἐνεργῶν ἐν ὑμῖν καὶ τό θέλειν καὶ τὸ ἐνεργεῖν ὑπερ τῆς εὐδοκ ίας.

To the physicist, this is one of the most remarkable passages in literature, sacred or

profane. The author was not thinking of physics, for it as yet had no existence; and yet these two sentences contain by direct expression and by implication the four fundamental laws of energy; the very vitals of modern physics. Nay, sixteen hundred years and more before Thomas Young, who uses the now accepted name for this wonderful power, the word energy occurs twice in this short passage of St. Paul's and, in its root, a third time. If we might paraphrase the apostle's utterance in the scientific language of our own day, it would run somewhat thus,

"Pass your energy on, as your safety requires; for the energy by which you will and work, is from God."

He tells His spiritual children, that in the Christian life, they are merely the transferrers and transformers of energy, and not its creators and originators. God's energy is transferred to them, and then it is transferred from them, in Christian work, to the world about them. It was given to them in the one form of grace and transmuted by them into a thousand forms of well-doing. In all this

they had not added any, having only given what they received. The law of conservation as well as that of transfer and transformation is recognized. But more than this, the apostle clearly teaches that "willing" is necessary to "doing" and that divine energy is required for each. "Willing" unlocks the potential energy of grace, and makes it active or kinetic, in "doing." Thus the strange and sublime parallelism of the moral and physical worlds is beautifully brought out. Hidden from the reader in the previous centuries, it shines forth to us like a facet of a long known jewel only now disclosed. How wonderful that the most precious truths of recent science should be found concealed in a sentence of twenty words written more than eighteen hundred years ago. If you tell me that St. Paul could not have had such anticipation of present day science consciously in his mind when he said these words, I am forced to believe that a greater than he was speaking through him. It was Paul plus Christ, and as the finite vanishes in presence of the infinite, I hear no one but

Christ. None but the Maker of the world could know it so well. Doubtless multitudes of other sentences in the Scriptures will also phosphoresce with new light when the radiations of future science are turned upon them.

Let us consider this pregnant statement of Scripture a few moments longer, in order to appreciate its wholesome lessons. The growing plant receives from the sun daily supplies of energy. Of the copious floods of heat and light which envelop our planet, a part is appropriated by living vegetation. These supplies of invisible power are materialized in the visible facts of growth. In all this the plant is merely a receiver. For its health, something more is needed. It must transform and give out this energy in leaf and flower and fruit. It must give it out in producing a multitude of seeds, and thus carry on the life of the species. There are two ways of killing a plant. One is to shut it off from the sun, and thus deprive it of light, heat, and moisture. It grows pale and feeble, and perishes. An equally effective way is to let it enjoy the sunshine, but to

keep it from giving out its energy. Pluck off its leaves and blossoms. Let it not bear fruit, and it soon ceases to be able to bear fruit.

So the bird that is prevented from flying, singing and nesting, dies as surely as the bird that is starved.

The star that is active is the shining star. Invisible stars are dead and cold. The Sea of Galilee and the Dead Sea are fed by the same waters. The Jordan pours its bright flood into each. Yet Gennesareth Lake is sparkling and clean because it gives as well as receives. While the Asphaltite Lake is bitter and foul, because it receives and never gives.

All nature is replete with instances of the truth of St. Paul's words. The melody of a musical sound, coming through the air, strikes with its unseen waves a thousand things. Only a few of them perhaps can vibrate in sympathy, and they at once absorb the passing energy, but only to give it out straightway in music themselves. The "working in" is immediately associated with

"working out." Thus one source of music may awaken a multitude of kindred singers, and make the whole air resonant with its melody.

So the glorious sun sends out incessant floods of energy in forms we know and it may be in other forms not now suspected. These streams flow out, enveloping in their progress planet, comet, and meteor-swarm—all of which take in, in different degrees, the passing treasure. They pay it back in the colours of nature, the blue sky, the green sea, the shining disc and in those invisible forms that mitigate the rigour of space and make the planet habitable, or lock it up in coal beds to have it liberated in some future age, when the fuel glows cheerfully in the grate.

Our views of the universal fact of "working in" and "working out" being inevitably associated in nature as in morals, have been immeasurably extended in recent years. A new department of physics, as noticed on a preceding page, has been created in the discovery of molecular radiation and transfor-

mation, or what is now called radioactivity. It has brought to our knowledge, as before mentioned, the previously unsuspected fact that the very ultimate elements of matter, the molecules of some, and perhaps of all orders are themselves the repositories of tremendous amounts of energy, which some of them are incessantly giving out, and yet have such a store that they may take many thousands of years before they are completely exhausted. But we also know that this energy was received from some previous store. It must have been "worked in," though the process of building up the molecule may have been a speedier one than that of "working out," just as it may take but a few moments to wind up a clock, which will take a year to run down.

We have before indicated that the suggestions of this remarkable scripture do not end here. In the endless transformations of energy in nature, much is put into the "locked-up" or dormant form called potential—such as they tell us exists in our coal beds, our mountain lakes, in all fuel and food, in

gunpowder and dynamite, and perhaps many unsuspected forms in which the things next to us may be rich—all these stores awaiting some directing touch at the right place to be released and expend themselves in a thousand modes of useful activity. In many cases the magic touch involves an act of volition on the part of the living being. The act of the will, like the engine driver's grasp on his lever, looses the giant and sets going the train. The willing starts the doing. It is the essential prerequisite in action, both in the kingdom of Nature and of Grace. Paul declares that the divine energy supplies power for the willing as well as the doing All is God's, and then all is the Christian's. The working is the transfer of the energy. Work it out, for God works it in you, and He does it of His own good will.

This tremendous passage of St. Paul's seems as full of science as it is of religion. Does any one say again that it is incredible that the writer could have had in conscious apprehension the world of physical truth we have seen that it holds? To us the improba-

bility that the real author of the wonderful sentence should not have meant what it means to us is on mathematical grounds so great that it cannot be entertained by a rational being. The difficulty does not exist to the Christian. It was St. Paul's sentence just as fully as though he were uninspired, and it was God's sentence as fully as though St. Paul were only His mouthpiece. If I may be allowed to give a very inadequate simile, the piano, on which Beethoven played, we may imagine to be endowed with life, consciousness, intelligence and will and to become automatic. Let its will be altogether one with Beethoven's so that what the great composer wishes to do is just what the instrument wills to do. The music will then be the piano's and at the same time the master's. It may well be that the intelligent piano would not realize all that the great performer puts into the transcendent harmony. Thus the words of Luke and John and Paul are the words of Christ, and the words of His inspired servants as well.

HARMONY OF THE TWO WORLDS

Did time allow, we might find other scientific hints in the Bible which strongly and powerfully remind us of truth in the material world—old spiritual truths suggesting new physical truths. The two worlds of nature and grace seem to be strangely parallel to one another. The analogies between them have arrested the attention of the thoughtful in all ages. The greatest teachers have found boundless resources of illustration and instruction in these parallelisms. Our Divine Master used them freely and often. Philosophers have accounted for them in various ways. Leibnitz declared there were only three ways of doing so. Said he, if two clocks were found to run together so that each one always indicated exactly the same time as its companion, it might be, firstly, because there is a mechanical connection between the two, compelling them to run together; or, secondly, some invisible agent by continual touches, now forward and now backward, may make one clock keep exactly with the other; or, thirdly, from a preëstablished

harmony, the two instruments were so contrived and adjusted by a sufficient intelligence that they, though physically unconnected, yet starting together, would always be together. The third explanation was the one adopted by this great philosopher.

The great Scandinavian scientist and reformer, Swedenborg, who was not the inferior of Leibnitz in scientific matters, was the author of a view which reminds us of the latter's first hypothesis, save that the connection between the two worlds in his view, while not mechanical, was equally effective and controlling. Swedenborg's doctrine of correspondences is founded on a great array of undeniable facts in human observation and experience. The great Northern leader no doubt pushed it to lengths to which many of us find it difficult to follow him. He appears to teach that a causal relation exists between the two worlds so that the changes in the visible sphere accompany those in the invisible, as instantly and closely as the image in a mirror copies an object and its movement.

In our times a young Scottish naturalist

and religious teacher, Professor Drummond, has given a solution of the problem which is quite startling. He declares that the parallelism in the two worlds is due to the fact that the laws of nature extend beyond the boundaries of the natural world and cover the spiritual world as well. Their working is in his view not analogical but identical. The position which the gifted Scotsman supported with a glowing rhetoric that captivated the world, is very hard for some students to accept. It would be easy to admit if one were a materialist or an idealist, for then the substance of both worlds would be the same. But to others, the difficulty at the confines of the two spheres, where the law would operate on matter on the one hand and spirit on the other is very great.

After all, the student of the Bible is not shut up to any of these theories. Leibnitz's three possible cases do not exhaust the question as he seemed to think. Neither world is a clock —or mechanical system—but a sequence of phenomena in which the Almighty Author is ever immanent. The Absentee God exists

not in the thought of the Christian. The two worlds are the simultaneous revelations of one and the same omniscient, omnipresent Being. Their harmony is therefore inevitable.

I live in the shadow of the mountain on which Thomas Jefferson had his home. We could once see there many features of his domestic life—in his peculiar views as to convenience, privacy and hospitality, shown in the disposition of the apartments and the furniture which filled them. This private record told of his method, his neatness, his originality, his industry. But there was another record; his public acts, and his wide correspondence and state papers. They reveal the same Jefferson whom his neighbours knew already from his home life.

It seems to me that the harmony of the natural and spiritual worlds is like the harmony made by the right and left hands of some great pianist. The parts are on different portions of the keyboard, but they march together. The one is independent of the other and might exist alone, yet each is incomplete without the other. The higher

strains of the right hand are in exact concord with the lower ones played with the left. One does not cause the other as Swedenborg thought, nor are they mechanically united so as to be necessarily coexistent, nor, in fine, are they the result of a preëstablished harmony from eternity as Leibnitz imagined. Their unity and harmony are not in and of themselves, but in the one artist who makes them both. He makes every concord and we stop short of the truth if we pause at the music or the instrument and do not pass to Him.

Is it not true then that Christ's worlds are each incomplete without the other? The world of matter needs the illumination of the higher world for its satisfactory study, while the loftier world is not completely understood without the help of the lower one, and in both we fail of their deepest meaning if we do not push on to Christ, the author of both.

LECTURE IV

CHRIST'S LOVE OF NATURE

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CHRIST'S LOVE OF NATURE

AMONG the great teachers of the world, Christ is remarkable for His habitual use of illustrations drawn from the external world, especially the scenes and objects of the region He moved in. The plants and animals, the landscape and skies of Galilee were a treasury He constantly drew from. Listen to one discourse. These familiar sentences are always beautiful.

"Ye are the salt of the earth," "Ye are the light of the world," "Let your light shine," "Your Father maketh His sun to rise . . . and sendeth His rain," "Lay not up treasures on earth, where moth and rust corrupt," "The light of the body is the eye," "Behold the fowls of the air," "Consider the lilies of the field," "A good tree cannot bring forth evil fruit," "A wise man built his house upon a rock and the rain descended and the

floods came, and the winds blew and beat upon that house and it fell not." And so always, whether speaking to the throng or to one hearer,—the multitude by the seaside or to Nicodemus at night, or the Samaritan woman at the well, the Master found the wind, and the water, the sea and the sky, full of spiritual meaning. To Nicodemus He said, "The wind bloweth where it listeth." To the woman of Sychar, "Whoso drinketh of this water shall thirst again."

Contrast Him in this love of Nature with other teachers before Him. Put a page of the sermon on the mount by the side of a leaf from Confucius or a dialogue of Plato. There is the same difference as there is between a herbarium and a garden. The earthly teacher is lofty, dry and contemptuous of the rabble. The divine teacher is simple, loving, and observant of every-day life. The highest ability is that which sees the wealth existing in common things.

These allusions to Nature give us an insight into a beautiful feature of the character of the Saviour. He must have been a close

observer of the external world. The boy of Nazareth had a keen eye for the changing seasons, the starry heavens, the glowing sunsets. He loved the rocks and hills about Nazareth, and doubtless knew every nook, every hidden dell with its murmuring brook. From the neighbouring height He had often looked over the great rich plain, with its waving corn-fields and bright river threading between. He saw Carmel like a crouching lion grandly framing in the picture on the south and west, and Tabor and Gilboa towards the east, while snow-crowned Hermon guarded the north. Great events had taken place in that scene, of which Joseph and Mary often told Him.

The smiling plain below Him had been watered with blood. It was the battle-ground of nations and the thoroughfare of the armies of Assyria and Egypt. There on Tabor, Barak had smitten Sisera, and near Gilead, Gideon had overwhelmed the Midianites. On Gilboa, Saul and Jonathan had perished. On the heights of Carmel just before Him Elijah had triumphed over

the prophets of Baal, and near Megiddo, good King Josiah had fallen by the hand of the Egyptian Necho. It may be that divine prescience momentarily illuminated the lad's mind and He saw the hosts of the Crusaders and the onset of Saladin at the Horns of Hattin, and later on the veterans of Napoleon crushing the Mamelukes.

We have been used to think of Palestine as an uninviting region, treeless, bare and hot. Very different is the fact as narrated by one who travelled there last spring.[1] He exclaims:

"Oh, the flowers of Galilee! The half was not told me of their profusion and beauty. No wonder our Saviour bade His hearers 'consider the lilies.' He must have loved flowers, and it is pleasant to think how much His beauty-loving soul, debarred from so much that we enjoy in art, must have delighted in the wealth of colour and the glory of form in which God has clothed the grass of the field in Galilee. I thought, years ago in the Engadine, that I should never again

[1] Christian Work and Evangelist.

so revel in flowers. All the fields and mountainsides are so covered with them as to look like a Persian carpet. But the Engadine flowers, though of every colour of the rainbow, and so profuse that you can hardly drop a pin and not touch one, are yet all of one sort. In Galilee there is an incredible variety not only of colours, but of species and families of plants. The clovers alone would suffice to make the country beautiful, so varied are they in size and form and texture and mode of blossoming, to say nothing of colour, and the clovers are only one of more than fifty sorts of flowers that we saw between Nazareth and Tiberias. There would be acres of a single sort of purple salvias, or deep blue lupins, or cream-coloured cistus, golden gorse, or any one of twenty other kinds, and between the splendid 'purple patches' would be any number of other sorts. Of course it is spring, and the flower season; but I am told that after the dry and thirsty land has forgotten all the rains, both 'early' and 'later,' and the flowers that are not so beautiful have passed away, then the thistles

will come out in all their glory and quite make good the lack of other flowers. One need not live long in Syria to feel sure that the curse—if it was one—of 'thorns and thistles' was spoken of this country. All winter long I have been delighted with the picturesque shapes and exquisite markings of a great variety of white or dark green vernal leaves growing close to the soil, and on asking what they were, have always been told: 'Oh, that's a sort of thistle.' Now these plants are thrusting up long flower stalks, some of them as tall as mulleins, and making ready to blossom. I counted seventeen varieties the other day on a walk of a quarter of a mile, and I am told that the blossoms of some of them are superbly beautiful and that they illumine all the land after everything else is parched and dried. One of the countless things worth seeing in the library of the Syrian Protestant College at Beirut is the herbarium of the thistles of Syria. I am afraid to say how many varieties."

Christ was a mountain boy and a mountain boy never ceases to love the hills. So

in after life, Christ always sought the mountains, when He wished to rest or pray, or speak to His disciples alone. Other teachers preferred the forum or the porch. He is the teacher of the mountain, which by its elevation, its stability, its bright light and open air, was the fit symbol of His doctrine. The forum and the porch are gone. The mountain remains, and the sermon on the mount bids fair to outlast the mountain itself. Discourses on these solitary heights, far away from all that could interrupt by sound or sight, must have seemed like voices from heaven.

And when again He retired thither to pray alone, He had a closet fit for the Son of God. The canopy above was lighted by the silent stars; the earth beneath was out of sight and hearing. Both place and time seemed made for communion with the Creator of all. Eternity and heaven seemed natural subjects there. Cato said that he was never less alone than when alone. Christ was not lonely on the mountain. His Father and the holy angels were with Him.

Happy is the man who loves the deep forest or the mountainside. If he is of meditative cast, he feels no lack of society there—all that is artificial in life, all vulgar display of fashion or wealth, the petty calls of business or pleasure,—these are gone, and great thoughts of a higher world and departed friends and love and hope enter and fill the soul. A traveller tells us of his feelings, when once by chance he was left for half a day on the snow near the base of Monte Rosa. Around him in every direction stretched for miles the smooth white surface of the upper glacier, rimmed at a distance with great snowy peaks,—the Breithorn, the Matterhorn, the Weisshorn, the Mischabel—and behind him the twin summits of Monte Rosa. In all that expanse was no sign of living thing beside himself. Man and his works were as if they had never been. Solitude indescribable—but silence, peace, rest, had universal sway.

The Master, by His constant employment of natural objects and events, in metaphor, simile and parable, gives to all teachers a

useful model. The highest success belongs to those who can enliven their instruction with apt analogies from the world about us. The higher world seems to cast its shadows on the lower. Every movement in the one has its parallel in the other. Nothing is more inspiring than the fertility of nature as a source of illustration. The mine has been used for many centuries but the ore is plenty yet. He who would be master of assemblies must be able to draw at will from this inexhaustible supply. He must love and study nature. This is the beauty of the mother's teaching. Our childhood's lessons and songs are full of metaphor, and when we grow old, we still rejoice to learn by parable. Æsop's fables have been from of old the teacher of all ages, child and sage. In childhood we delight to sing of the "little drops of water" and "the little grains of sand," while in mature life we are stirred by the grand word painting of Shakespeare as he sings of "the cloud capped towers, the gorgeous palaces and solemn temples," and their transitory character. Many of the most celebrated

passages of the great dramatist are only an artist's picture of nature. He knew, like the Master, the power of such illustrations over old and young. The teacher who has that love of nature and knowledge of her ways, is admirably equipped for his work.

But the aptness and fertility of illustrations drawn from nature are not more striking than the universality of its use. Not only all ages but all races of men are best instructed by analogies, drawn from the visible world. The Oriental peoples, permitted or obliged by their climate to spend so large a part of their lives in the open air, and in lands where the sun puts so much of its energy into magnificent plants and noble animals, have a literature which is full of allegory. In the frozen North, the richness is transferred from the snow-covered earth to the splendid lights of their heavens. The bard in Iceland, like his brother in the vale of Cashmere, clothes his thoughts in the garb which nature offers him. The one uses the meteor and the polar light where the other sings of the rose and the nightingale. The unity of our race is plainly

shown in the universality of this practice. As water quenches the thirst of all races alike, so all delight to be instructed by fable, allegory and parable and such a fact shows that they are of one blood.

But its universality is not more striking than its variety. Would a speaker be ever fresh and interesting, let him live close to nature, in any of her provinces. He will find his increasing store of knowledge to be an inexhaustible treasury of suggestion and illumination. People never grow weary of first hand illustrations. To find new meanings in familiar things is irresistibly engaging and pleasing. It strikes one like a new discovery. If the fact be new as well, its power is less, but still unmistakable. The infinite variety of Nature is like the infinite number of melodies that may come from a single instrument. Paganini, Vieuxtemps, Wilhelmj, all used the same simple four-stringed violin. Each drew from it a wonderful series of beautiful strains, characteristic of himself, and stamped with his peculiar genius. No one repeated the other's com-

position, yet all together, and all the masters of the violin beside, have not exhausted its possibilities. Future virtuosos, for centuries to come, will find in it new treasures of melody and harmony, and then leave thousands of combinations of tone unrevealed. Nature, like her author, is infinite.

It is remarkable that the greatest painters do not paint the least thing from their own imagination of what it ought to be, if by possibility they can get an actual model of it. They seek among the faces of a crowded city for the face they want. The attitude, the pose of limb, the swelling muscle are all copied, not conceived. They will not paint the folds of a robe or the form of a clinging scarf from memory or fancy. The artist may have glorious visions of sky and landscape—of face and form. He paints not from these but from nature, owning by this that she is above art, and that he must humbly learn at her feet.

It is worth noting, that Christ, in His habitual employment of the objects and events of the world about us, to make clear divine

truth, never allows the beautiful simile to be so prominent as to draw attention from its object. His illustrations are always subordinate. We have known, in the case of other teachers, the illuminating comparison to be made in such detail and at such length, that the real purpose and meaning were lost and the accessory became the principal. It is then like the splendid robe in a modiste's window, which draws attention away from the waxen figure within—whereas an illustration should be like the same robe on a beautiful woman, and be only noticed on a second glance. Our Saviour's practice is a valuable lesson in the proper use of such rhetorical adjuncts. His love of Nature is not more obvious than His teaching that she is handmaid not mistress. Listening to Him, we think of the Father's care, then of the lily and the sparrow—the strait gate does not hide the way to heaven, but reveals it. Webster's morning drumbeat, on the other hand, saluting the flag of England and circling the globe, is repeated by admiring thousands who know nothing of and

care nothing for the connection in which it was introduced.

In striking contrast with Christ's love of nature and the constant use He made of it is the barrenness of natural metaphor and simile in the writings of the apostles. The chiefest among them, St. Paul, is singularly restrained in the use of natural events for the purpose of explanation or illustration. The few times in which he allows himself to introduce such aids, emphasize themselves by their rarity. He likens the resurrection of the body to the germination of the seed; and the ranks of the redeemed to the different glory of the stars. We may well believe that the great practical features of the message which the apostles bore—sin, repentance, faith, holiness—to a world sunk beyond our imagination in the most outrageous and open forms of vice, so filled their souls as to leave no space for thoughts of illustration. Exhortations to a drowning man to seize the rope we fling to him, are apt to be brief and unadorned. The spiritual peril of their hearers absorbed their entire attention, and Nature and Art

were forgotten. How else could a highly educated scholar like Paul, who knew the great classics, and had a soul sensitive to the beautiful, stand amidst a throng of Athenians on Mars Hill with the wondrous Parthenon before him, crowning a mighty array of lesser temples, and the great statue of Athena towering above him in flashing light from her helmet's plume and glistening spear, and fail to notice them even by a word? Their ruins draw less gifted men from distant lands and reward their journey. Paul's speech as reported might have been made in a desert.

Is it possible that this strange oblivion of his surroundings, or insensibility to them, may have been partly due to a defect of vision? Quite a number of passages in his letters support the familiar tradition that the great apostle suffered from some affection of his eyes, that was quite obvious to all who saw him. May it be that Paul bore throughout life marks of that memorable incident on the road to Damascus, when he was stricken to the ground by a brightness above the

splendour of the noonday sun? It is quite possible that, while his sight was restored sufficiently for the ordinary daily intercourse of life, his vision of distant objects was imperfect. It may be that he bore through life in his face, about his eyes, the effects of that dazzling stroke of light, so that those who met him on the street would look at him and ask about him. "This is the man," they would be told, "who saw the Lord in glory and was struck blind." What an affecting sight it must have been to those who loved him and his Master, to have thus constantly recalled the stirring history of his strange conversion. He had seen the King on His throne—he had not seen Him in His humiliation at Jerusalem, for Paul was a proud young Pharisee, engrossed in the study of the law under the great doctors, and no doubt disdained, even if the rumour reached him, to seek the humble Nazarene among the common herd of Galileans. But he did see Him exalted and seated at the right hand of God, and had little sight for aught else ever afterwards.

However that may be, the fact that Paul took little account of the physical world as a treasury of valuable emblems for the teacher need not trouble us. His Master did show by His practice, that it is the highest wisdom to make such use of nature. We need no other example than His for our guidance. The Master is greater than any servant of His. Paul himself would only wish us to follow him as far as he followed Christ.

After all, we must not expect the follower to be more than a partial copy of his chief. Christ's servants are finite and limited in their powers. His service is so rich and vast that it requires the special gifts of a multitude of men adequately to fulfill it. The man of sober, dry reason is needed. So is the plodding scholar; the man of poetic genius and rich imagination is needed. So too the man of hot emotion, the man of imperial will, and the gentle spirit that meekly follows its leader—all are needed. Paul, Peter, John, Augustine, Francis, Bernard, Luther, Melanchthon, and a host beside, no two of whom are alike, are required for the

infinite work of expressing their Master to men. In all the coming time, in the development and enlargement that awaits humanity and the varied forms of achievement which will elevate the race, the Christian scheme welcomes and will find ample room for all.

With the evidences of Christ's love of Nature before us, it seems strange that in so many ages of the church, Christians have looked with suspicion if not with enmity on the study of the visible creation. They feared or believed that it led away from the Master not to Him. When the honest votaries of science were led to views of the world different from those which pious people had formed from a hasty interpretation of Biblical expressions, never meant to teach science, they were at once classed with the infidels, and their learning was denounced as irreligious. It is not Galileo, whom in this day we look upon as wrong, but the churchmen who pursued him. We have learned slowly that to reject a creed is not of necessity irreligious, and that honest search for truth is a

Christian trait in the scientist's laboratory or in the pastor's study.

Perhaps this antagonism to Natural Science has with many good people been due to an unconscious transference of the term "world" in the New Testament, meaning the then existing society and its wicked ways, to the visible world itself, coupling the wicked and their habitation together. The ancient Persian myth of this world as the theatre of the activity of Ahriman, the Demon of Evil, seems to have survived in Christian lands, in the belief that Satan had much to do with natural events. The study of them it was thought led away from what was good, and at least was dangerous to faith. The pious monk withdrew not only from society, but often into desert places, away from the beautiful in nature, her singing birds and laughing streams and waving forests.

Against all this we must cite the example of our Lord. He loved the material world. And why should He not? It is the work of His hands, for "without *Him* was not anything made that was made." By His incessant

power and oversight it is maintained. In all its infinite variety of structure and function, we may see the signs of His presence and activity. He loves His own work, for He pronounced it good. His followers should love it too. It is full of Him, His care, His love, His forethought, His wisdom. "For the invisible things of Him, from the creation of the world are clearly seen, being understood by the things that are made, even His eternal power and Godhead." "He left not Himself without witness, in that He did good and gave us rain from heaven and fruitful season filling our hearts with food and gladness." If the men of that time could see God's power and goodness in the events of nature, plainly revealed in what was open to all, what shall we say of our own day, when the child knows more than the sage did then. Every one will agree that the material universe, as we know it, discloses most wonderfully the majesty and might of the Creator, while the hidings of His power in the great realm of electricity and the world of the atom are yielding to the searching of men ineffable lessons of His wisdom.

The rapidly increasing knowledge of Nature is bringing out into clearer light that there is a plan in the world, and hence there must have been a Designer. What the material universe taught us of God in the early ages, it still teaches with increased force and added richness. The multiplicity of facts accumulating from year to year does not impair the unity of creation. The great trunk is branching out into many limbs, and these are blossoming with a thousand beauties, but it is still one tree. If Christ be the maker of all worlds, there must be harmony between all worlds. If the worlds visible and invisible are from the same hand, correspondence and parallelism between the two are to be expected. Neither is complete or entirely intelligible without the other. They are complementary, because they came from the same author, not by accident or self-evolution. The unity of the creation, physical and spiritual lies in the unity of the creator. It is vain to seek for the unity of a musical composition in the vibrating chords or the ivory keys, bound together as they are. They have connection,

but none to account for the great motif. The performer explains the performance.

If these things be true, two important conclusions follow:

Firstly. The course of Nature cannot be fully understood, without reference to the higher world. Many lives may be spent, it is true, and well spent in the research into one world alone or even a small part of one world. It still remains a solemn truth that we shall never know the material world without connecting it with the spiritual world, of which it is the shadow. We need Christ in our Natural Philosophy.

Patient work in the laboratory reveals facts. A dead universe, however wonderful or vast, has no power to awaken the interest of an immortal being. But how is that universe lifted, if its beauty and order are symbols and results of the movements of the Divine mind, repeating themselves by contemplation of the material in the mind of the observer. Even the materialist is not content with a blank recital of the phenomena of nature, ending in the enumeration. He is perpetually associ-

ating them with the men who discover them. Thus, Comte said he saw in the movements of the planets only the glory of Copernicus and Newton. How much loftier did the Jewish king rise when he said "The heavens declare the glory of God and the firmament showeth His handiwork"?

The material world means nothing to the brute. It means little more to the savage, who may indeed see a power behind the scenes, but a malignant power. How worthy of its boundless extent and variety it appears, when it is regarded as the handiwork of the same Being whose offspring he is, and for whose education it was made. Then is it first seen that the smallest portions of it, as well as its grandest collections and systems, equally express the Creator's perfections. The tent of the fairy, Paribanou, could when folded be carried in the pocket, but when spread it covered a great army. The stellar universe manifests, under the eye of Chalmers, the infinite glory of a Maker, but not more perfectly than the bit of radium bromide, that is a universe in miniature.

I repeat it, let us then dismiss the fears of our forefathers, that the right study of nature is dangerous to morals. No human knowledge, not even the study of theology, can take the place of that which is only the Divine gift, attained by faith, but these human sciences rightly used may powerfully support and cultivate that grace in the upbuilding of character. Great advances in physical sciences were made during the French Revolution, and were associated with rank infidelity, but the science was not the cause of the infidelity. The French peasant thinks the brightness of the moon makes him ill and wilts his plants, whereas it is the thin cold air that does both.

Nature is no substitute for grace, but is beautiful as a humble handmaid to it.

But secondly. The higher world is not complete without the lower. The relation is reciprocal but not equal. Our study of the Lord's use of natural things warrants us in saying, that the highest use of the temporal and the seen, is to throw light upon the unseen and eternal. We have a striking

analogy in the history of astronomy. The science of the heavens made slow, painful advances as long as the worlds, celestial and terrestrial, were regarded as independent and unconnected. When Newton demonstrated that they were parts of one and the same system, the result was speedy and marked. The physics of the earth was greatly aided by studying the same forces acting in the skies under far simpler conditions, and more than all, the science of the heavens—astronomy—was aided in turn from the earth, so that it has grown more in two centuries since Newton, than in twenty centuries before him.

As Christ loved Nature, we should expect those who are endowed with His spirit to love it too. It ought to be very easy for them to do so. In this connection I would venture humbly to appeal to those, whose conversion has been sudden, to support the testimony of many such, that the world around them seemed to be likewise a new creation. There was a brightness in the light, a beauty in the landscape, a music in the

sounds of nature, as if a new-born soul had seen and heard it all for the first time. When a Christian is born again, all nature seems to him to be born again. So general is this experience, that the exception noted in the recent testimony of Dr. E. E. Hale, Jr., who was converted at a meeting lately held in Schenectady by Dr. Dawson of London is quite remarkable. Dr. Hale in a most interesting account of his great transformation, says that he became conscious of a curious change in himself which he did not pretend to explain. "Art, literature, scholarship, the theatre, the various things that had filled my mind," says he, "lost attraction." "Plans, ambitions of one sort or another, of which I had a number in hand, no longer interested me." "The attraction of Nature held on longer than the rest. I remember one morning looking out of the window at a row of elms, that I had for years looked at with delight while dressing. I said to myself I wonder if that is going too, and before I had finished the sentence, I was aware that love of nature had gone with the rest. Doubtless

those interests will return. I am sure I hope they will." Let us join him in this hope. Surely his new-born love for his Lord will cause those elms to whisper to him a sweeter story, for they too are Christ's.

The Master's love of Nature, considered as a trait worthy of our hearty imitation, is especially to be commended to our own American people. With us life is intense, pressing, keen. We seem to drink in with our mother's milk a restless spirit, that carries us into man's responsibilities before we lay aside our jackets.

When we enter the office or the shop, the throttle is thrown wide open and we plunge along at our highest speed all through the working hours. The spirit is contagious, and becomes an American characteristic in every department of life. We put our hotels on wheels and call them Pullman cars, for we cannot do as our fathers did and stop over at night. We sleep and eat while rushing over the land at fifty miles the hour. The telegraph does our talking, for we cannot wait for the mail. This rushing habit follows

us into foreign parts, and makes us known among the quiet Europeans and still slower Asiatics, as uncomfortable wonders. The greatest things in the world cannot be done in a hurry, and these things we miss.

As the pendulum released from one extreme, swings to the other, so our people, in their recreations, are not content with the simple, quiet humour of older, less intensely active races. The London *Punch* seems to us like a piece of didactic propriety. We require the coarse extravagance of the comic supplement of a Sunday newspaper—Buster Brown, Mr. Hooligan and Gaston and Alfonse suit us better than the cartoons of Leech or Du Maurier. It is the recoil of human nature from the cruel tension of our business ways.

To these tired Americans, we would suggest that they try, instead of the comic papers, the tonic power of a love of Nature and communion with her. Our Lord found sweet relief among the hills or on the wave. So may His followers. The world He made has inexhaustible variety. There is no mood of

the human soul which may not find sympathy in some part of the universe.

Are we meditative? The silent forest, the solitary mountain or the quiet stars seem to share our seriousness and induce serenity.

Are we gay? The songs of birds, or the murmur of laughing streams form a musical accompaniment to our gladness. Are we craving action or longing for a struggle? An hour with the oars, spent in conquering the waves and facing the salt air, will give new life to our bodies and new strength to our hearts.

Are we depressed by the ingratitude of men? A brief time spent daily with the hoe in our garden, will teach us how grateful are our humble friends, the plants, that reward our attention with a return it may be of a hundredfold; or if we like it better, we may ramble with the faithful dog, who will show us that a lowly brute may feel an attachment in which there is no insincerity and no inconstancy.

The Master has many higher ways of meeting His people—in prayer and song,—in

meditation—in closet and church, but He may be met too, as He meant us to meet Him, in His works, if we only look for Him. And so, in words familiar from childhood, yet always fresh and beautiful,

"Our lives, exempt from public haunt
May find tongues in the trees, books in the running brooks
Sermons in stones and [1]—Christ—in everything."

[1] "Why callest thou Me good?"

LECTURE V

CHRIST THE MODEL FOR THE TEACHER OF SCIENCE

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CHRIST THE MODEL FOR THE TEACHER OF SCIENCE

THE knowledge of the physical world is largely acquired, not by personal research but from the testimony of others. Science, for even the most learned, is mainly "the knowledge of many men, orderly and methodically digested and arranged, so as to be attainable by one."[1] Personal research in physics is confined for each student to a limited portion of Nature. As the years go on, this possible field for any individual is getting smaller and smaller. Philosophers once could survey the universe: to-day they find too vast a field in a single molecule. The atom has become a universe. For our knowledge of Nature, except a minute portion, even the student of science must rely exclusively on the accumulated re-

[1] Sir J. F. W. Herschel.

sults of the researches of others, conveyed to him by such interpreters as he believes to be competent and true. Laboratory cannot replace the lecture-room, any more than the lecture-room can replace the laboratory. Each is indispensable and complementary. Testimony must not be disparaged as a means of knowledge, for the larger part of what one knows has always, and will always be derived from it. He who takes nothing on the witness of others, and demands personal immediate knowledge of all he accepts, will have a short creed, and be but little better than an ignoramus. The accumulated experience of our race, preserved, arranged, and conveyed to us in books and discourse—in library and lecture-room—is man's priceless heritage. The function of the teacher in university, college or school is to be this interpreter between the past and present. He may seek to increase knowledge and ought to do so, but his greater duty is to diffuse it. It is for him to acquaint himself with the augmenting stores of discovery, to coördinate them, to convey them in proper order

to the pupil and to train him to make use of them. The teacher has always been a respectable member of society. If his profession has not been as highly honoured as it deserves to be, perhaps it is often because the teacher himself has not estimated it at its real value. He belongs to a noble line. Great teachers have been great figures in history. They have left more enduring marks upon our civilization than kings, or marshals, or ministers.

The teacher, I venture to think, may learn useful lessons in the practice of his important calling, from the life of Christ. He was, of choice, a teacher. He might have come to earth as a philosopher, or a prince, or a great soldier. He chose to come as a teacher and so forever lifted that calling to primacy among all professions.

He came not merely as a teacher, but as a college teacher. He founded a college. The civil law had it, that it took three to make a college. A master and two pupils were enough. In Jerusalem at the time of the Advent, there were colleges with famous mas-

ters. The names and something of the teaching of Hillel and Shammai and Gamaliel have come down to us. The college was not so large as to require more than one master. He made the entire faculty and taught all the branches offered. This had been the style in Athens for centuries. Socrates, Plato and Aristotle had been heads of such schools. The head master taught his scholars in an apartment, or walking in a portico, or in the shade of a leafy grove. They appear to have had access to him, not only at stated hours, but often as companions for a large part of the day, asking him questions, and answering them.

When He, whom we worship as omniscient became a teacher, we may well study His methods, in the communication of knowledge and the training of His pupils. Surely the humble teacher of human science may hope to find some valuable light for his guidance in a secular profession from the life of the great Teacher.

Should we find the methods used by Christ to be often those to which, in the long cen-

turies since His time, teachers having no reference to Him, have been slowly led by painful experience after many mistakes and frequent retirement from disappointing experiment,—it will only confirm our faith in Him as the source of light and truth. It will make teaching-science also Christo-centric.

LET US REVERENTLY STUDY THE MASTER'S COLLEGE METHODS

We are first struck with the fact that Christ chose His more intimate pupils, not they Him. At the close of the course, He reminded them of this. They had before entrance to pass under His scrutiny. These picked learners lived with their Master, journeyed with Him, ate with Him, listened to Him in the walk, and at the resting place, and held His words in tenacious memories, more durably than if they had been cut in stone or metal. They saw His mighty works which gave new meaning and force to His words. The twelve formed His inner circle. They were to be His heralds to all the world. Beside these, there was a number much greater who were also disciples, but probably

not constant attendants. They gathered about Him when they could. To them He spoke, too, and showed His power, and used them as His messengers to the region near by.

The modern professor, with his seminarium of selected students, and his large class of beginners who are admitted to the elements, but not to the penetralia of the subject, is doing in the twentieth century what the Master did in the first.

Christ's method of teaching is most instructive. It was, of necessity, oral, and not text-book, teaching. We may well believe that formal discourses at great length were few. The remark dropped on a journey, the brief answers to questions, the interviews in their presence with other inquirers or objectors, together with the wealth of meaning embodied in His works of mercy,—all together constituted a priceless curriculum. A few of His extended discourses are reported at length. What we may call the introductory and valedictory lectures are given in full; they throw wonderful light on our study of the great Teacher.

Shortly after the choice of the twelve, what we would at this day call their matriculation, we are told that Jesus, seeing the multitude, withdrew to a mountain, whither His disciples followed Him. Certainly the twelve were there, and finally, doubtless many others—but His evident wish was to speak to His disciples. Here He delivered what may be regarded as the introductory lecture of His course. It has ever been esteemed as a most precious deliverance. Many pious people have been disturbed at not finding in this fully reported discourse a complete exposition of the Christian Scheme. It contains no gospel of Sacrifice or Substitution, no call to repentance, no emphasis of faith, no assertion of His Deity. The beautiful form of prayer it sets does not ask forgiveness in the Saviour's name. Can that be a model sermon that makes no mention of the Cross?

Such difficulties disappear if we are entitled to regard the Sermon on the Mount as the opening lecture of a course. In such a discourse we do not look for and ought not to find a summary of the course. Such would

be unintelligible. We may look for a brushing away of impeding prejudices, a clearing off of obstacles to entrance on the new way, and a glimpse at some old things in the new light.

The Sermon on the Mount begins with some startling paradoxes calculated to arrest the attention and stir the expectation of the young pupils. They had spent their boyhood in what the Jews regarded as the outskirts of civilization. Galilee was to Judea what the Smoky Mountains are to Knoxville. Yet these hill-people had heard of the great Emperor at Rome, of his power and wealth, and had seen something of the magnificence of his vassal, Herod Antipas, at Tiberias, near by. They had at times gone up to the great feast at Jerusalem, had looked upon the splendid temple, its gorgeous priests and solemn ritual, and had gone back to their humble homes and weary lives. To them happy and enviable were the rich and proud. Happy were those who rejoiced; who were richly fed and clothed; who hungered only after more wealth and power; who were

haughty towards inferiors, and who delighted in war; whom poets sang of and all men praised.

Nay rather, began their teacher, happy are the humble, the meek, the pure, the merciful, the despised and persecuted. Such are the salt of the earth and the light of the world.

What a tumult must these words have caused in such hearts! They stir us after nineteen centuries of progress. What an upsetting of cherished ideals—and sweeping away of prepossessions! Christ has here given, if I mistake not, a valuable hint to the teachers of to-day. Paradox is inevitable when wrong notions are to be replaced by right ones. Surprise and wonder are the necessary concomitants and badges of ignorance. *Nil admirari* is only possible to omniscience. To awaken wonder is contemptible when it is done to mystify or mislead, and only then. 'Tis a natural prelude to the conveyance of truth and in this use it is not only admissible but commendable. Our pupils must be aroused from intellectual

slumber, and paradox is a shake of the shoulder to them.

After this unique introduction the disciples were left in the state of men who, where they thought the way plain, have unexpectedly tripped over an obstacle. They were humbled, but intellectually wide awake. Their teacher, having their undivided attention, proceeds to disabuse them of the idea that these opening sentences may have suggested to them. He is no destructive innovator. He exalts the law and the prophets whom they have been taught to revere from earliest childhood. He is come to fulfill not to destroy—to complete not to lessen. The law is eternal. Its human excrescences are temporal. It is hard for us to realize the attitude of the Jewish mind of that day towards their law. Their religious leaders seem to have largely abandoned all reference to it as a rule for the inner life. Sin was altogether in the external, visible act. So was righteousness. The law had no eye for motive. The commandment to do no work on the Sabbath could not be violated by any

amount of thought about business, but it would be broken by having one nail more in one shoe than in the other. The teaching of the synagogue doubtless like that of the scribes, was filled with such petty and absurd trivialities, and under such tuition these young fishermen had grown up. To them comes now by the word of Christ a revelation of the spirituality of the law. It was a voice from heaven at whose divine accent these incrustations of human ingenuity fell away, disclosing the perfect beauty they had hidden. The key-note of this memorable discourse seems to be the infinite worth of the spiritual put against the vanity and transitoriness of the visible. Ritual is not worship. It may help it, but at best it is only the body whose soul is the real service. Such a foundation truth deserved such a place of honour in the gospels. Human nature requires to be held to it by iteration and reiteration under divine influence. We swing away from it so easily and lapse into formalism and mere outside cleanliness.

The Sermon on the Mount has many strik-

ing features beside, which are of value to the instructor. The simplicity of the language, preserved so admirably in our chief English version—a simplicity not childish but child-like—the clearness of a deep pool—is a model which every one should imitate, though few or none can reach it. Magniloquence often hides poverty of thought. Simple language is the badge of strength, and the natural garb of truth. The Bible, and especially the gospels are the "well of English undefiled." In its style, it is the noblest pattern of our mother tongue in its most perfect form.

Note too the Saviour's use of common things for illustrations. He found ample material in the familiar matters of daily life. A far-fetched, novel or laboured incident, draws attention to itself and so instead of setting the theme in clearer light, darkens and obscures it. Teachers and pupils alike dread triteness. Like the Athenians, they demand some new thing. Triteness however is not in the thing or its frequent recurrence, but in the way it is used. The flowers of spring, the stars of heaven are with us always. Though seen

again and again, they are never trite. Our Master here gives us a profound lesson for our guidance in trying to teach others. Use familiar things by preference for illustration, but use them freshly. They all have meanings yet undiscovered. Let us seek to bring out the hidden significance of common things. Our industry or penetration is exhaustible, not their richness.

In a previous connection we have noted Christ's constant employment of the events of Nature in His teaching. His inaugural lecture, the Sermon on the Mount, is full of them. The light, the rain, the wind, the lily and the sunshine are cited and forever identified in the thought of after ages with spiritual truth. The light suggests personal influence, the lily assures of the Father's care, while the rock and the storm typify the security of the godly.

What we may call the college course of the apostles covered according to the common understanding about three years; rather less, perhaps, than more. Of the Master's instruction there is preserved no systematic

account, if indeed there was a system as we understand the term. His method, as we have before indicated, was education by constant personal intercourse, continuous in influence, yet as to speech fragmentary. There were searching questions on what had been taught; the putting of instructive cases for their meditation; and, at times the puzzling of them with seeming contradiction between prophecy and fact. These things He often did in their presence with His objectors and foes. He seemed fond of the Socratic method of making the learner teach himself. Doubtless what He did with others, He did also with His immediate disciples. Christ's example puts an emphasis upon the necessity of personal individual work with the student if we would accomplish the best result. The great assembly with its hundreds of eager listeners, and its speaker, stirred to his highest effort by the stimulus of the subject and the hour, has its place in the university. Large classes, in some subjects and some aspects of every subject, are useful and even indispensable. But they are not best for training. Like the

rapid dash of an express train through a lovely country, they reveal the great features of the landscape in their large outlines and composition, but to know that country will require also the pick and the spade, the level and the tape. Neither can do the work of the other. It is curious to watch the oscillation in our educational centres between the extremes of class-teaching solely and of individual teaching solely. The happy mean is the true and wise way, and that was our Saviour's way. In the English universities, in former days, lectures to great classes held an insignificant place. In our own land they once held almost exclusive place.

Meanwhile we suggest that it would much add to the value of such important changes, if their success or failure could be promptly communicated to sister institutions for their guidance. We seek the same great ends, through methods of various merit.

We note also that Christ taught His pupils how to do things by letting them see Him do those very things. His mighty works were done in their presence. These works relieved

suffering and manifested His divinity, but had besides an educational value. We who never saw a miracle cannot perhaps realize the tremendous impression which such an act must have made on the beholders. Apart from awe and reverence, in presence of power, was the lesson of the spiritual nature of Christ's lordship, when, often the forgiveness of sins went with the healing of the body.

But the Master did not limit His teaching to words, or to acts of His own. First among great instructors, He gave emphasis to what we call now laboratory work, that is to putting the pupil to practical use of his knowledge and to personal testing of asserted truth. Very soon in His ministry He sent them out into the villages and country sides of Galilee, to preach and to heal—to do, in fact, what they had seen Him do. He gave them minute directions as to their conduct both among friends and enemies. We may well imagine the excitement made in a Jewish village by the coming of a disciple of the Great Prophet of whom they had heard so

much. He would surely appear in their synagogue and then in their streets and houses, telling them the good news, healing their sick, and casting out demons from notorious subjects. The missionaries returned to the Master exulting in their newly-found powers. Here is a profoundly philosophic feature of pedagogy, lying before our eyes for centuries, but without serious recognition. The necessity in an all-round system of education that the pupil should make his knowledge an intimate personal possession, which he cannot fully do without coming into such close contact with truth as practice involves, has been slow of admission. The antiquated systems made the student merely an absorber. The new system makes him in a sense, a rediscoverer. Once the teacher and text-book were everything. Now the laboratory is also essential. But, as in all reforms, the pendulum preserves its centre only by swinging to extremes. When instructors waked up to a consciousness of this serious defect in their arrangement, there were not wanting enthusiastic

men who demanded nothing but laboratories in the educational apparatus. They utterly deprecated lectures and book work as mere telling about things imperfectly, when in the laboratory the things themselves were at hand, waiting for recognition. Happily the good sense of trustees and boards resisted the pressure. They sought to adjust rationally the balance between oral teaching and practice. In fact, they have settled upon the plan shown near twenty centuries ago by our Lord, of combining judiciously the lecture-room and laboratory—the map and the journey—the model and the copy.

In our reverent study of even the minutiæ in the practice of the greatest teacher of the world, we mark that He sent out no one alone. His missioners went in pairs. He, Himself, needed no coadjutor, but He knew that each young disciple would be the better for a companion. In wisdom, in courage and strength, two are better than one. The English Methodists find it so and station their ministers in pairs. Part of the success of the false system of the Latter Day Saints is

doubtless due to their sending ministers to foreign or hostile places always two and two. Even in physical laboratories it is found often to be wise to have the students work in pairs.

Note also another delicate point, full, is it not? of suggestion and inspiration to the plodding teacher—the frequent repetition by the Master of statements or illustrations. This seems to have given to some harmonists a world of trouble. Assuming that there was no such repetition and that the same sentences in the different gospels must refer to the same occasion, great pains have been taken by some to harmonize the narratives even by violent wrenchings of the text.

Is it beneath the dignity of a wise teacher to repeat his phrases in dealing with immature minds? Nay, does not experience convince us that it is both wise and necessary? Learning is a slow painful process, advancing not steadily but like walking by constant fall and recovery. It is by incessant repetition, as the wearing of marble by long dropping of water, that lasting impressions are made on the young mind. Those studies in the

curriculum in which such repetition is most frequent and natural are just those which the verdict of ages has declared to be the best instruments of culture. I venture to think that this is one of the reasons why the study of the ancient classics as an educational gymnastic has held so high a place in the schools for thousands of years. The relations of words in discourse are phenomena which in their elementary facts are simple, of easy analysis and within the grasp of the beginner, while in their more delicate features they require and reward the highest ability of the scholar.

The construing and parsing of page after page from day to day is ever bringing to view the same principles in a variety of relations, so that the rules of grammar are at last graven ineffaceably on the memory. It is inductive science, too, which the pupil is practicing, for he is taught that the rule flows from the practice, not the practice from the rule. In teaching the physical sciences such repetition is not so common, while the phenomena are not so easily apprehended by an immature mind,

for taken singly they are such as seem to disprove our laws. It is only when the tolerably mature student has somewhat mastered the science of errors, that he is able to rest in truth derived from inexact results. Hence it seems to some that such studies are not the best for beginners.

Genuine classical study, as a branch of inductive science, instead of being unfriendly as a preparation for the study of the natural sciences, should be an admirable introduction to it. In the old curriculum, the judicious mingling of classical and mathematical study formed a happy introduction to the study of nature, opening up a new and beautiful field in which the methods were familiar while their application was novel.

The Master was not always with the disciples. There were frequent solemn hours when He withdrew to the desert or the solitude of the mountain top, some lonely spot where no one intruded. Sometimes a whole night passed before He sought again the company of His followers. The teacher must have much time alone. Without those hours

of meditation and separation from the pressing throng of active duties, his ministry will be jejune indeed. The hidden life supplies the public life. The sources of our great rivers are not in their visible fountain-heads, but in the invisible air in which those waters are dissolved, which presently will fill their channels. We have Christ's great authority for the teacher's demanding large time apart from lessons and lectures,—time for recreation in its highest sense—the revival of his powers—the renewal of his zeal—the nourishment of his mind. Some teachers find in society or in charge of work a great relief. They unbend the bow, they say, and thus maintain its elasticity. The recreation I speak of is something different from mere amusement. It is communion with a higher world. To do that best the man must be alone. Solitude, not society, best promotes this flow of new energy into his soul. From such hours he comes forth to his followers with his face shining with a new light.

On the other hand, human nature is so complex that our needs are wonderfully varied.

The Master often retired so as to be alone. But again, He sometimes left the familiar, well-trodden paths of Galilee, and with His chosen followers resorted to the capital city, with the throngs of worshippers from all parts of the earth, converging to the great feasts. There in the great assemblies, gathered in the courts of the splendid Temple and overflowing into the streets and over the surrounding hills, they caught the inspiration and uplift which come from sympathy and contact with our fellow men.

The teacher's life, if spent entirely with his pupils, apart from the great world, may be rich with the fruits of meditation and study, but is in danger of narrowness and self-centreing. Now and then, he should abandon solitude, and seek to touch the great throbbing world outside. Man was made for society and such occasional approaches enlarge the teacher's views, brush away the cobwebs of provincialism and freshen his sympathies. His pupils will notice the added spirit and life of his teaching, and catch new interest themselves.

There is another fact in Christ's life, to which the attention of American teachers may profitably be drawn. "He began to be about thirty years of age," says St. Luke, when He commenced to teach. The long period of preparation, in the little village hidden away among the hills of Galilee, covered childhood, youth, and apprenticeship in the carpenter's shop—*thirty* years of training for a service of *three*.

We think of those seasons of waiting at school or synagogue or workman's bench, and cannot help wondering that Divine wisdom and power should seemingly have been kept in obscurity so long. To our poor darkened apprehension it is so mysterious that the transcendent gifts for which the earth was waiting and groaning should be delayed or postponed. Of course it is all due to our ignorance. Doubtless could we know all, we would see that great blessings to our race were secured by those silent years of tutelage. One blessing at least we may thankfully receive. Our race and especially our age needs the great lesson that preparation for duty,

ample and minute, had best be made before undertaking that duty; and that deliberate careful training is no waste of time. Better thirty years of drill and three years of service, than three years of training and thirty years of imperfect work. The one changes the world, the other does not often outlast the worker.

By no nation on earth is a warning of this sort more sorely needed than by our own American people. The character of our environment; the freedom of our institutions; the vast things that may be done and that press on our attention before we are grown; the possibilities of wealth and honour, nay the very tension of our eager, bright atmosphere producing a singular nervousness and excitability; all conspire to push our young people into the business of life before they are mature.

In no profession is this more frequent than in the responsible one of teaching—whether in the pulpit or the recitation-room. Here the example of the great Teacher supplies us with a warning and a pattern. Would we

be successful in the high calling? Let us make sure of it by patient, thorough preparation. Let our American public be impressed with the need of this, and cease to tempt bright but immature young candidates to premature exertion. This stimulus sometimes kills. Let our faculties, boards and friends of colleges make it *possible* for American youth to spend double the present period at school, and then let them make it *necessary*.

Teaching from the sacred desk is held in highest honour in our land. Secular teaching, too, should be a profession as honourable, as exacting and as well paid, as that of law or medicine. To that end, it should be life-work—not a makeshift leading to something regarded as more worthy. The teacher is more often the butt of the village wit than the doctor or the lawyer, because his calling stands lower in public esteem than theirs. It stands lower, because teachers themselves often have a low estimate of it. This will never be changed, while it is regarded as a profession, requiring little or no preparation,

and which almost any person may fill. Our divine Master honoured the office by choosing it for Himself, and in His short, active life gave us a model in every aspect of it which we would do well to follow.

With two exceptions, Christ's discourses are reported by the evangelists only partially. There are two, however, which are given at greater length. One of them was the Sermon on the Mount, which we have ventured to call Christ's introductory lecture to His college course. The other may be called His valedictory, the closing lecture of His course. They are given by different evangelists. Plain, businesslike, Judaic Matthew was chosen to tell us of the former. It was doubtless a labour of love with him to magnify the law of Moses and exhibit its unsuspected contents to his readers.

But when the last words were to be said to the same men, enlarged and developed by years of association with a lofty character, another type of reporter was needed,—one of warmer feeling and finer mould, an eagle,

not a man or ox or lion—a poet, not a writer of prose. Of all the four evangelists John was the one best fitted for the task and John was selected. The inaugural was given on a mountain apart, away from the multitudes, but to a small company that grew perhaps into a crowd. The valedictory was spoken in a small room again to the disciples alone, yet in the midst of a city crowded always but then overflowing with visitors. The little company was alone with their teacher but not far from the crowds He came to save. His parting accents fell upon their ears mingled with the hum of voices, and tread of feet, of the outside multitude, decreasing at that hour, but not yet hushed to silence.

The two discourses, the first and the last, are strikingly dissimilar. In the Sermon on the Mount, their Master in His divine offices, is not mentioned at all. In the final discourse He is prominent. In the one the endearing relation between His pupils and Himself is not emphasized. In the other it forms the warp and woof of the discourse.

One is all law, the other all gospel. The fatherhood of God is in both. The brotherhood of Christ is only in the latter. The Holy Spirit is not named in the first. In the last He is conspicuous.

The Christian teacher of science may humbly accept the lessons here suggested, as to the natural and wise conduct of his lectures. At the outset he may begin with a clear awakening statement calling his pupils away from prejudice and giving them a glimpse into the region about to be entered; aiming at the creation of interest and the removal of stumbling blocks. But at the end comes the parting. How different is it then after years of personal contact, when the expanded minds of the scholars, informed and disciplined, have qualified them to begin independent life for themselves! Surely then, along with summaries of truth already conveyed, there will come parting words from the heart. The light of the final lecture will not be the less for the warmth of the parting friends.

Great Master, thou art the way to all truth

in heaven and earth, and through the truth, to the highest life! That life is only complete, when heaven and earth both contribute to its richness.

LECTURE VI

THE GREAT TEACHER HIMSELF

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THE gospels reveal to us a grand character in presence of which their other contents fade from our view, as lesser lights always do before a brighter one. When we contemplate *Him*, all thoughts about methods of teaching are forgotten and we are engrossed with the teacher Himself.

Other biographies give us often a principal figure in a background so interesting as to divide the attention of the reader. In a life of Napoleon, we may see more of France than of him. Marshall's life of Washington is perhaps most valuable as a history of the times in which he lived. The life of Christ is a canvas in which the background is unseen, while we gaze on Him. Every detail contributes to the prominence of the central figure. Some human biographies have approximated to this and are famous in pro-

portion as they do. The greatest among them is doubtless Boswell's great work. In it, well nigh every paragraph teaches us something of Johnson. But after all there are Burke, Reynolds, Goldsmith, Garrick, Langton, Beauclerc and a long list of distinguished names beside. They stand around Johnson on the same level and while revolving about him, divide our attention with him. But Christ and His companions are not on the same level. In our first study, we see "no man but Jesus only." Upon a second view, we may discern Christ's comrades at His feet.

Another striking difference between the gospels and other biographies is this. Great human characters require a lifetime for their complete exhibition. They must be studied in youth, in manhood and in old age. The revelation of a great life is usually slow. The complex demands the threescore years and ten for its development. The richest part of such a life is its old age. In this alone we fully see the harvest sown in early life. The fire and passion of youth, the vigour

and activity of manhood, are replaced by the higher serenity and calm wisdom of the sage, in which we discern what is best and noblest in the man himself. Surely a human biography is unfinished, if it stop short of the afternoon of life. Yet Christ's biography covers less than three years of His life. A few glimpses only of His infancy and boyhood are given. Like instantaneous photographs, they raise questions which they do not answer. Beside these, only a fourth of a decade of His manhood is revealed. Then the curtain falls. The cross has suddenly closed His career as a man. For Him, there is no afternoon or sunset. He passes behind the veil in the fullness of His manly strength. Children may draw near to Him who was once a child. The youth and the mature man may feel encouraged to trust in Him who knew, by personal experience, the dangers and needs of both. But the aged man must seek for other sources of hope. Christ was never old. Yet no one has ever found His portrait incomplete. In some strange way, this fragment of a life, disclosed the

whole man. They tell us that the smallest fragment of a diamond, has in perfection all the properties of the gem. For its complete description in angle, lustre, form and colour, we need only the tiniest sparklet. So it seems to be with this great life.

The biographers of other men are greatly helped by having—indeed, for any serious work find it indispensable to have—writings of their hero—his own letters, or journal, or essays. In some cases, a man's correspondence with little besides, makes up what we call his life. He writes his own biography unconsciously in his familiar letters, or his more serious compositions. So true is this, that in writing the life of another, he may also write his own. Boswell's Johnson is Boswell's Boswell. The Evangelists give us no line written by Christ. If He ever wrote a line, we have no record of it. Once, 'tis said that, stooping down, He traced with His finger in the dust on the temple floor——words we would give our libraries to know, but which the next breeze or the next foot-print obliterated. His words were from day

to day committed to the most transient thing in the world, the idle air, to be lost apparently when their echoes were gone. They were not lost, but have been ringing round the world ever since. He committed them to the minds of loving pupils, and loving memory is a record more durable than engravings on marble or brass. Horace in a memorable ode boasted that by his writing he had made for himself a monument loftier than the pyramids. Jesus Christ, without writing, made a monument which will outlast the stars. This fragment of a life, reported by His humble friends, has by universal consent, taken the highest place in literature—a place unique and solitary, high over all in its class. Even His enemies, through the long ages since He was on earth have virtually said with Pilate, "We find no fault in this man," and with the officers of the temple, "Never man spake like this man." We recall the familiar story of Charles Lamb, that in a convivial company the question was asked what they would do if certain great characters of history were to appear among them. One said, "What if

Shakespeare were to enter?" "Oh, we should all get upon our feet," said Lamb. At last it was asked, "And what if Christ should appear?" All levity faded from gentle Elia's face, and after a pause he quietly exclaimed, "Then we would all fall upon our knees." That is the attitude which the finest spirits of the earth feel like taking in the presence of Jesus Christ, and of no one else born of woman.

What amazes us in this is that the character of Christ is not the one which poets, sages and historians have drawn as the ideal of humanity. Homer's hero was Achilles, active, passionate, inexorable, fierce. Confucius exalts the "superior man," dignified, just, correct, but concerned only with the visible and the present. Buddha crowns the man imperturbable, immovable, unconcerned. Carlisle's heroes are men of strength, like Cromwell or Frederick the Great, feared by thousands, loved by none. Perhaps the qualities most admired by man are seen in that romantic hero of our boyhood, Richard Plantagenet, fearless, strong, unselfish in

some things, chivalrous, hating his enemy, quick in revenge, but merciful to the weak. This great figure of the third Crusade, like the other leaders of the Christian hosts, is in marked contrast with the character of Him whose sepulchre they devoted life and fortune to repossess. Meekness to them was contemptible; to Him it was blessing. They, when smitten, would smite again. He would turn the other cheek. He exalts forgiveness. They honour revenge. Kill your enemy, said the Crusaders. Love your enemy, said Christ. Is our ideal to-day, much higher than that of the Crusaders? We laugh at their chivalry and count it fantastic. Yet that was the ennobling feature of those strange expeditions.

It was unselfish. It called for sacrifice. The object was a mistaken one, but the spirit was noble. Cervantes meant to hold chivalry up to ridicule by connecting its practice with the freaks of a lunatic. Yet such is our homage for courage, truth and loyalty that our laughter at the absurdities of Don Quixote is lost in our involuntary respect for his bravery, his unselfishness, his respect for

woman, his abhorrence of oppression. If the great writer meant to make the knight contemptible, as well as comical, he has signally failed. The gaunt horseman, with his unworldly life, has captured our esteem. Far higher is it to take a drab for a lady than to degrade a lady into a drab. Don Quixote is a finer gentleman than Charles the Second.

May I say, in parenthesis, that to some of us it seems that society in our own land, may well cultivate and honour what is best in chivalry. Our critics say, we seek and worship money. The pursuit of wealth is not wrong, if we join to it reverence for the uncommercial, unselfish, altruistic qualities in human nature. May we not have in our social relations, our dealings with one another, those great traits we are showing as a nation in our lifting the weak and poor, and in reconciling the bloody wars of the rich and strong? As a people we can be gentle, though great; peace-makers, though powerful; liberal, though rich. May we not wisely seek to show these qualities in our homes? Our American character is bound to be a complex

one, and in this fact doubtless stands our hope of its final excellence. Upon our Anglo Saxon stock have been grafted branches from all the countries of Europe. To the push and energy, the common sense and common law of the Briton, have been added the dash of the Frenchman, the patience of the German, the ardour of the Italian and the reverence of the Swede. These streams coming to us from widely different sources, do not remain separate. The open pulpit, the public school, the daily newspaper—the party platform—the railroad and the telegraph, are so many stirrers, which at no distant day promise to make us a homogeneous people. All patriots will pray that the composite American character may be a chivalrous one in the highest sense. Have not Christians a peculiar interest in this result? Can we leave chivalry out of our religious culture, without having a defective result? Christians speak of their Master as their brother. They bring Him down to their side. They delight to think of Him as walking with them in the paths of life and sharing their daily struggles. It is a beautiful and

comforting conception. But is there not another? That brotherhood also lifts *them* to His side. He is a Prince. If they are His brethren, they are children of a King. Their conduct should conform to their high rank. *Noblesse oblige.* In humble discharge of daily duties, one may, by sweet serenity show a loyalty to high lineage—a spirit of other-worldliness—which will make his simplest action noble and his "meanest work divine."

The character of Christ is strikingly distinguished from the highest ideals of mere human creation in another feature. In our portraitures, we make a clear difference between the manly and the womanly model. In much, they are so distinct as to be contrasted. The traits we call by the two names are as different from one another as womanly beauty of face and form from the manly type of both. It is counted a reproach for a man to be feminine, or for a woman to be masculine. Raphael, in his "School of Athens" has been thought by some to have exceeded the painter's license, in representing some of his men

with the features of women. In our family discipline, the models held up for our boys are always men, and for our girls they are always women. We would no more propose Robert Lee as a pattern for the latter, than Mary Lee for the former. Yet we feel no incongruity in pointing both sexes to Christ as an example of the highest excellence. This is another mark of the loftiness and eternity of the Christian ideal. The Master Himself tells us that in heaven they neither marry nor are given in marriage, but are as the angels of God. In that higher sphere all that is temporary and provisional disappears. The diamond there is divested of its setting. Whether it came from a wedding ring or a sword hilt, it flashes out with the same splendour. Christ's character on earth was connected with the shop and the synagogue, but it was the same which now shines out among the seraphim ; the same yesterday, to-day and forever.

Seeing then that the portrait drawn in the gospels is universally reverenced, while it is so unlike that which our race admires, the

contradiction involved need not put us to permanent mental confusion. The inquiry is aside from our purpose, but we may suggest that human nature is complex, including a higher and lower self. We have every day judgments for passing events, and we have solemn, deliberate judgments for august occasions. The two are not always harmonious. Our secular heroes are apt to be mere enlarged projections of ourselves, like the spectres of the Brocken. But our divine hero is an image from heaven. The difference between the two conceptions appears to be largely in the place assigned to the gentler virtues in the two, and also to the different idea of courage embodied in them. Napoleon at the bridge of Lodi, or Winkelried at Sempach, is the expression of the one view. The courage of Christ is of a higher type. "Strength," says Carlisle, "is best shown not in spasms, but in stout bearing of burdens." It takes a finer manliness to endure in patience the malice of evil men, than to rush upon a hostile rank. The British line at Waterloo showed a rarer fortitude in standing

under fire for hours without flinching, than in the final dash at the supreme moment, which swept away the broken foe. The idea that meekness is inconsistent with manliness is a fallacy resulting from taking self-control for weakness, as if in mechanics one should take equilibrium for rest. There are two things one cannot injure by a blow, a mountain and a mote. There are two beings one cannot insult by reproach—a baby and an archangel. Both are meek, one is strong. The loftiest natures are both gentle and brave. The Scottish ballad made Douglas tender as well as true. Dr. Gessner Harrison's definition of a gentleman, was that he was a gentle man.

We have thus gotten some glimpses of the Great Teacher as delineated by those who were with Him. Two of them were His pupils, and two were so near to His daily associates that their record is practically that of eye witnesses. We may well believe that the society of such a teacher, the observation of His daily life in every detail was a commentary on His spoken words, explaining, expanding and enforcing them. The simple

narrative of the few of these smaller incidents which were preserved is full of pathos. "Jesus hungered," "Jesus wept," "Jesus looked on Peter." If these words have such a world of meaning for us who read them after nineteen centuries, what must the acts have meant to those who saw them! Christ's words "blessed are the merciful," must have had new and never forgotten meaning to those who shortly after, saw Him touch the bier at Nain and give back to the weeping mother her only son. Christ's example magnifies the importance of the personality of the teacher. The matter taught and the method of conveying it are not all. The teacher himself counts for a great deal. Christ said, "I am the truth." No written page or spoken sermon could take the place of the living, moving incorporation of the truth, seen in Himself. The highest truths must be personified, to be fully comprehended. There is such a thing as living our lessons before our pupils. It may be a mark of immaturity, but learners are always less impressed by the abstract than by the concrete. When the great sage was asked,

what is motion? he might have gone into a disquisition, which would have made his own reputation, while it left the inquirer in a state of admiring ignorance. He did not do this, but merely arose and walked across the room, saying, "you see it."

The teacher's life may not only be valuable as a commentary on his teaching, but the very warp and woof of his lessons may take a tinge from his character. I have heard it asked sarcastically, "Is there such a thing as Christian mathematics?" "Is there a Methodistic demonstration of the binomial theorem?" To the surprise of the inquirer, we may answer, yes. A demonstration may be slovenly and in bad taste; it may be careless and therefore defective; it may be forced and so fallacious. A slovenly, careless, illogical demonstration is unchristian. The teacher who daily sets before him as a part of his religion, the striving for the things that are lovely and true and honest will make his mathematics graceful and sound, and so, there is such a thing as Christian mathematics. Are not those in error who regard

any part of science as beyond the domain of ethics? The true can in thought be separated from the beautiful and good, but not in practice. The Principia of Newton, or the Analysis of Sturm or Poinsot awaken in the competent student not only satisfaction with the logic but a sense of the beautiful and often the sublime, just as the Pantheon satisfies the engineer by its stability, while it fills the soul of a poet with its grace and richness. If I may be pardoned for personal reference, the culture given by the study of Greek and that of the mixed mathematics seemed to me to be much the same. A play of Sophocles and the Lunar Theory were much alike in the faculties they appealed to and helped to discipline. Each exercised both reason and taste, and each demanded earnest, strenuous effort. Science is everywhere penetrated by the moral qualities of the teacher. His work and words are himself. A noble man transfuses his nature largely into his teaching, and happy are the students who walk with him. For the highest form of education, one must therefore

touch and enter the life of a great man Familiarity does not breed contempt, except it be with people really contemptible. Great teachers are like the great mountains. To be fully known, they must be seen near at hand, as well as afar off. The distant view reveals the grand outlines and the comparative height. The nearer aspect opens up characteristic details and interesting peculiarities. The tourist looking from the top of Righi admires the Alps. The Swiss mountaineer loves the Alps. So a really great teacher, admired and honoured by the distant public, loses not by the near approach of his pupils, but warms their admiration into affection.

The importance of the teacher himself as a factor in Education is made more obvious, when we abandon the ordinary narrow meaning of the word and rise to the thought that Education includes the discipline of the entire man, heart, head and hand, and fills the whole life, not merely a few school years. The catalogue of any university is largely taken up—naturally and rightly so—with

what concerns the intellect; the subjects taught, the methods pursued, the text-books used. But we all know that a student gets a vast deal more at college than what is taught in the lecture-room or learned in the study. The large life outside of the lecture-room, the association on equal terms with picked young men from all parts of the land, each one, like himself, the centre of interest to a distant household, and representing their social status: this attrition polishes his manners, enlarges his sympathies, removes narrowness and bigotry. He meets his fellows in the classroom, in the debating-hall, and at the dining-table. He is learning how large the world is, and how small his native village appears. There, too, is the athletic field. When properly conducted it is a training-ground for the mind and heart as well as the body. It may develop self-control, courage, patience and a high tone of honour and truth, if, as the directors should aim to bring about, the contestants prefer defeat to unfair advantage. Thus the college diploma represents but a small part of what

the college does for him. The fine collegian is a rounded man; in mind, a scholar; in manners, a gentleman; in body an athlete; in all things a Christian. The professor's duty does not consist of his lecture merely. If that were all, we might replace him with a phonograph. The assembled class might see upon the platform, not a living form, but a machine charged with the wisdom of Kant or Hamilton or Helmholtz. But the "vox et preterea nihil" would never do. We need the flash of the eye, the wave of the hand or the stamp of the foot, giving emphasis and life to the utterance. The teacher's duty too does not cease with his lectures. Some of his most enduring work is done outside of his lecture-room. His daily walk before the student body, his cheery greeting, his word of courage to the faint and of warning to the erring constitute no small part of his value to the institution. What, I may ask of the older men present, of all the impressions made upon us at college do we retain most vividly now? Are they the demonstrations and lessons of the recita-

tion-room, or the memories of our teachers and of the friends we made and kept? The most of us have vivid pictures of the splendid men who taught us, but very dim ones of much of their teaching. At our alumni meetings, the speeches of the old boys are full of personal reminiscences, but contain no hint of those valuable lectures. It has been so always. The teacher himself is more than his message. We know Dr. Arnold of Rugby, by his pupils' loving description of him and his ways, but Tom Brown has forgotten all about the doctor's elaborate views of *ut* and the subjunctive; the doctor was a real presence to his boys throughout their lives. To them, Arnold was Rugby and Rugby was Arnold. When we read his sermons to his pupils—and good manly talks they are—they do not suggest to most of us the greatness of the man. What is that nameless atmosphere that surrounds a truly lofty character; that electric aura that can neither be denied nor explained? It is not great mental power, nor strong will nor saintliness. Perhaps we shall have to go beyond this world to find the secret.

Among our prominent teachers in Virginia two generations since, was a man who in his way was as remarkable as Thomas Arnold. I refer to Gessner Harrison—a name honoured by thousands, including many who never saw him. A scholar, original and advanced, he revolutionized the teaching of Latin and Greek in this land. Trained in the formal methods of the English school, he early discerned and became familiar with the superior insight and freedom of the German scholars. He made use of their results years before they were mentioned in any lecture-room of our own country and when they were unrecognized in many schools of Germany itself. He became famous as a teacher, but was quite as remarkable as a man. His simplicity of manner, kindliness of speech and act, his thoughtful regard for the young and his unselfish labour for others, converted respect for the scholar into love for the friend. Doctor Harrison was a very decided man in all his convictions. He was passionately devoted to the South in the days leading up to the war between the states. He would

have been called an extremist by some. Yet when just after the first battle of Manassas, certain wounded Northern prisoners were brought to Charlottesville to be cared for, he was seen, with his Bible under his arm, quietly seeking these poor fellows, trying to relieve their misery, and point them to a Saviour. He was a conspicuous example of the teacher himself, humbly imitating the model set by his Master.

If I desired an instance nearer our own time, I need not go beyond your own university grounds. There walked among these scenes a few years since a great man, whose memory should ever be a precious heirloom of this institution. He was remarkable for the extent, variety and accuracy of his knowledge. In his day it was quite possible for a man to be a master in several departments. Now a small section of one department must engross his labour, if he wishes to speak with authority. Learning was telescopic then. Now it is microscopic. The old-time men had a wider range. Doctor Landon Garland was a mathematician, a physicist, an astrono-

mer, a mineralogist and botanist, proficient in all and remarkable in some. It was however in a sphere beyond this that his greatest work lay. His wisdom in council, his dignity and seriousness in public, his simplicity and sincerity in private relations, all crowned by his steady devotion and consistent piety, united to form a character unique and influential. Long will he be remembered. His opening addresses each year in your university chapel should be preserved and heeded. Hundreds, who came under his influence here, will cherish a loving regard for his worth, coupled with admiration of his intellectual strength. While he lived, he was your grand old man, the Gladstone of your academic circle and of the Methodist Church South. Among the conspicuous men who have served Vanderbilt University in board or faculty, none stand higher than Landon Cabell Garland.

Did time allow, I might speak of Tutwiler of Alabama, Thornwell of South Carolina, Broadus of Kentucky and a distinguished list besides, who in their lives illustrated the

thought suggested to us by the example of Christ, that the personality of the teacher is a most important factor in the result of his work.

It is timely to say that the American college teacher, at least, must be more than an expert in the subject he teaches. Our governing Boards do well to look beyond the candidate's diplomas and list of published papers. The American teacher must know his specialty and how to teach it, but he must be a man fitted by character, manners and proper respect for youth to be trusted with the training of our sons. No skeptic or immoral man should have access to these young lives, with the sanction of our Boards of Trustees. Freedom of thought always, but freedom of conduct never. The academic liberty, for which some are loudly contending, means apparently in some cases, freedom to mislead and destroy. If we can have the right men in our teachers' seats—men who may be safely followed by our boys in conduct as well as in learning, questions about the Bible in schools become easy to settle.

The living Epistle will be known and read of all the pupils.

We have tried in these studies to present Christ as the centre of science—a place that belongs to Him as the Lord and Maker of all worlds. We have attempted to show that the greatest things in the book which reveals Him to us are in accord with the soundest science both as to fundamental truths, and the moral qualities inculcated. We have essayed to point out that the teachers of science may get valuable lessons in their profession from the study of the Master's example. We have ventured to look aside from the lofty theme of His mission, the salvation of the world, and we think we have found that this sublime strain is attended by subordinate harmonies of this lower world, and that Christ is Lord of matter as well as of spirit. The recognition of this grand unity of creation, with Him as the head, is plainly advancing among men to-day. His sceptre bids fair to stretch over the Orient. No one will be surprised, if the great movements of our day

should make of Japan a great Christian people. Then China will follow, and as once before the Wise men came from the East, so the faith of these Western lands may in their turn be quickened and purified by messengers from these new-born kingdoms of our Lord.

It will be a glorious day when the recognition of Christ as the Master of all worlds, the source and support of all activity in all spheres, shall be complete; when we shall not only admit but realize that we may serve Him, and must serve Him if we would succeed, in the laboratory and the gymnasium as well as in the closet and the church; that whatever we do well is done for Him. His name may not be mentioned, but His spirit will be in the act. Life, in all its details will be service. It will be lifted to a higher plane. Our daily work will be better, because it is no longer toil, but obedience.

Christian believers are sometimes depressed in these days, because of the skeptical tone of much of our literature—the hostility of some leaders in science and the indifference or even the loose conduct of some who are classed